INSTALLATION MANUAL

R-410A
ZJ SERIES

3 - 5 Ton

60 Hertz

TABLE OF CONTENTS

General 2
Installation 5
Preceding Installation 5
Limitations 6
Location. 7
Rigging And Handling 7
Ductwork 15
Condensate Drain 16
Compressors. 16
Filters 17
Power And Control Wiring. 17
Optional Electric Heat 27
Optional Gas Heat. 28
Options/Accessories 30
Standard Economizer and Power Exhaust Set Point Adjustments 31
Airflow Performance 35
Air Balance 38
Checking Air Quantity 38
Operation 42
Cooling Sequence Of Operation 42
No Outdoor Air Options 42
Cooling Operation Errors 42
Electric Heating Sequence Of Operations 44
Electric Heat Operation Errors 44
Gas Heating Sequence Of Operations 45
Ignition Control Board 45
Gas Heating Operation Errors 45
Start-Up (Cooling) 47
Start-Up (Gas Heat) 47
Checking Gas Heat Input 48
Charging The Unit 50
Troubleshooting 51
Fan On And Off Delays. 54

LIST OF TABLES

1 ZJ037-061 Unit Limitations 7
2 Weights and Dimensions 8
3 ZJ037-061 Unit Accessory Weights 8
4 ZJ037-061 Unit Physical Dimensions 11
5 ZJ037-061 Unit Clearances 11
6 Side Duct Dimensions. 13
7 Control Wire Sizes 19
8 Electrical Data 20
9 Physical Data 24
10 Electric Heat Minimum Supply Air. 27
11 Gas Pipe Sizing - Capacity of Pipe 28
12 Gas Heat Minimum Supply Air 29
13 Supply Air Limitations 33
14 Altitude/Temperature Correction Factors 34
15 Airflow Performance - Side Duct Application 36
16 Airflow Performance - Bottom Duct Application 37
17 RPM Selection 38
18 Indoor Blower Specifications. 38
19 Power Exhaust Specifications 38
20 Motor Sheave Datum Diameters 40
21 Additional Static Resistance 41
22 Electric Heat Limit Setting. 44
23 Electric Heat Anticipator Setpoints 45
24 Gas Heat Anticipator Setpoints. 47
25 Gas Rate Cubic Feet Per Hour 49
26 Gas Heat Stages. 49
27 Unit Control Board Flash Codes 55
28 Ignition Control Flash Codes. 55

LIST OF FIGURES

1 Unit Shipping Bracket 5
2 Condenser Covering 5
3 Compressor Section 5
4 Predator® Component Location (ZJ037 Shown) 6
5 Unit 4 Point Load Weight 8
6 Unit 6 Point Load Weight 8
7 Center of Gravity 8
8 ZJ037 Physical Dimensions. 9
9 ZJ049-061 Physical Dimensions 10
10 ZJ037-061 Unit Bottom Duct Openings 12
11 ZJ037-061 Unit Electrical Entry 13
12 ZJ037-061 Unit Side Duct Openings 13
13 ZJ037-061 Unit Left Duct Opening 14
14 ZJ037-061 Roof Curb 14
15 ZJ037-061 Transition Roof Curb 15
16 Side Panels With Hole Plugs 15
17 Return Downflow Plenum With Panel 16
18 Discharge Panel In Place. 16
19 Condensate Drain 16
20 Field Wiring Disconnect 18
21 Typical Control Wiring 19
22 Side Entry Gas Piping 28
23 Bottom Entry Gas Piping 28
24 Enthalpy Set Point Chart 32
25 Honeywell Economizer Control W7212 32
26 Belt Adjustment 33
27 Altitude/Temperature Correction Factors. 34
28 Dry Coil Delta P 39
29 Typical Flame. 50
30 Typical Two Stage Gas Valve 50
31 Typical Single Stage Gas Valve. 50
32 Unit Control Board 54

General

York® Predator® units are single package air conditioners with optional gas heating designed for outdoor installation on a rooftop or slab and for non-residential use. These units can be equipped with factory or field installed electric heaters for heating applications.

These units are completely assembled on rigid, permanently attached base rails. All piping, refrigerant charge, and electrical wiring is factory installed and tested. The units require electric power, gas supply (where applicable), and duct connections. The electric heaters have nickel-chrome elements and utilize single-point power connection.

Safety Considerations

⚠ This is a safety alert symbol. When you see this symbol on labels or in manuals, be alert to the potential for personal injury.

Understand and pay particular attention the signal words **DANGER**, **WARNING** or **CAUTION**.

DANGER indicates an **imminently** hazardous situation, which, if not avoided, **will result in death or serious injury.**

WARNING indicates a **potentially** hazardous situation, which, if not avoided, **could result in death or serious injury.**

CAUTION indicates a potentially hazardous situation, which, if not avoided **may result in minor or moderate injury.** It is also used to alert against unsafe practices and hazards involving only property damage.

⚠WARNING

Improper installation may create a condition where the operation of the product could cause personal injury or property damage. Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual for assistance or for additional information, consult a qualified contractor, installer or service agency.

⚠ CAUTION

This product must be installed in strict compliance with the installation instructions and any applicable local, state and national codes including, but not limited to building, electrical, and mechanical codes.

⚠WARNING

Before performing service or maintenance operations on unit, turn off main power switch to unit. Electrical shock could cause personal injury. Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information consult a qualified installer, service agency or the gas supplier.

⚠ CAUTION

This system uses R-410A Refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system. Gage sets, hoses, refrigerant containers and recovery systems must be designed to handle R-410A. If you are unsure, consult the equipment manufacturer. Failure to use R-410A compatible servicing equipment may result in property damage or injury.

⚠WARNING

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS:

a. Do not try to light any appliance.

b. Do not touch any electrical switch; do not use any phone in your building.

c. Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.

d. If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

Due to system pressure, moving parts, and electrical components, installation and servicing of air conditioning equipment can be hazardous. Only qualified, trained service personnel should install, repair, or service this equipment. Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters.

Observe all precautions in the literature, labels, and tags accompanying the equipment whenever working on air conditioning equipment. Be sure to follow all other applicable safety precautions and codes including ANSI Z223.1 or CSA-B149.1- latest edition.

Wear safety glasses and work gloves. Use quenching cloth and have a fire extinguisher available during brazing operations.

Inspection

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier's freight bill. A separate request for inspection by the carrier's agent should be made in writing.

⚠ CAUTION

This product must be installed in strict compliance with the enclosed installation instructions and any applicable local, state and national codes including, but not limited to, building, electrical, and mechanical codes.

The furnace and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing at pressures in excess of 1/2 PSIG.

Pressures greater than 1/2 PSIG will cause gas valve damage resulting in a hazardous condition. If it is subjected to a pressure greater than 1/2 PSIG, the gas valve must be replaced.

The furnace must be isolated from the gas supply piping system by closing its individual manual shut-off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG

Reference

Additional information is available in the following reference forms:

- Technical Guide - ZJ037-061, 528150
- General Installation - ZJ037-061, 527730
- Pre-start & Post-start Check List
- Economizer Accessory -
  Downflow Factory Installed
  Downflow Field Installed
  Horizontal Field Installed
- Motorized Outdoor Air Damper
- Manual Outdoor Air Damper (0-100%)
- Manual Outdoor Air Damper (0-35%)
- Gas Heat Propane Conversion Kit
- Gas Heat High Altitude Kit (Natural Gas)
- Gas Heat High Altitude Kit (Propane)
- –60°F Gas Heat Kit
- Electric Heater Accessory

Renewal Parts

Contact your local York® parts distribution center for authorized replacement parts.

Approvals

Design certified by CSA as follows:

1. For use as a cooling only unit, cooling unit with supplemental electric heat or a forced air furnace.
2. For outdoor installation only.
3. For installation on combustible material and may be installed directly on combustible flooring or, in the U.S., on wood flooring or Class A, Class B or Class C roof covering materials.
4. For use with natural gas (convertible to LP with kit).

⚠ CAUTION

This product must be installed in strict compliance with the enclosed installation instructions and any applicable local, state, and national codes including, but not limited to, building, electrical, and mechanical codes.

⚠WARNING

Improper installation may create a condition where the operation of the product could cause personal injury or property damage.

⚠ CAUTION

This system uses R-410A Refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system.

Nomenclature

3-5 Ton York® Model Number Nomenclature

Z	J	061	N05	A	2	A	AA	1	0	1	2	4	A

Product Category
Z = A/C, Single Pkg., R-410A

Product Identifier
J = 12.2 EER /15.0 Seer A/C

Nominal Cooling Capacity
037 = 3 Ton
049 = 4 Ton
061 = 5 Ton

Heat Type and Nominal Heat Capacity
C00 = Cooling Only. No heat installed

Single Stage Natural Gas Heat Options
A05 = 49 MBH Output Aluminized Steel, Single Stage (037,049)
A07 = 65 MBH Output Aluminized Steel, Single Stage (037, 049, 061)
A09 = 97 MBH Output Aluminized Steel, Single Stage (037, 049, 061)
A13 = 129 MBH Output Aluminized Steel, Single Stage (061)
B05 = 49 MBH Output Stainless Steel, Single Stage (037, 049)
B07 = 65 MBH Output Stainless Steel, Single Stage (037, 049, 061)
B09 = 97 MBH Output Stainless Steel, Single Stage (037, 049, 061)
B13 = 129 MBH Output Stainless Steel, Single Stage (061)

Two Stage Natural Gas Heat Options
N05 = 49 MBH Output Aluminized Steel, Two Stage (037, 049)
N07 = 65 MBH Output Aluminized Steel, Two Stage (037, 049, 061)
N09 = 97 MBH Output Aluminized Steel, Two Stage (037, 049, 061)
N13 = 129 MBH Output Aluminized Steel, Two Stage (061)
S05 = 49 MBH Output Stainless Sleel, Two Stage (037, 049)
S07 = 65 MBH Output Stainless Steel, Two Stage (037, 049, 061)
S09 = 97 MBH Output Stainless Steel, Two Stage (037, 049, 061)
S13 = 129 MBH Output Stainless Steel, Two Stage (061)

Electric Heat Options
E03 = 3 KW (037)
E06 = 6 KW (037, 049, 061)
E08 = 9 KW (037, 049, 061)
E15 = 15 KW (037, 049, 061)
E20 = 20 KW (049, 061)
E23 = 24 KW (061)

Product Style
A = Style A
B = Style B
C = Style C

Configuration Options (not required for all units)
These four digits will not be assigned until a quote is requested, or an order placed.

- SS Drain Pan
- CPC Controller, DFS, APS
- Johnson Controller UNT 1126 (N2 protocol), DFS, APS
- Honeywell Controller, DFS, APS
- Novar Controller, DFS, APS
- York Commercial Comfort SYstem (YCCS) Rtu Controller
- Simplicity IntelliComfort Controller
- Simplicity IntelliComfort Controller w/Simplicity®Linc
- York Commercial Comfort System (YCCS) Rtu Controller
- 2" Pleated filters
- 4" Pleated Filters
- BAS Ready Unit with Economizer
- Any Combination of Additional Options that Don't Have an Option Code Pre-assigned

Product Generation
1 = First Generation

Additional Options

AA = None AB = Phase Monitor AC = Coil Guard AD = Dirty Filter Switch AE = Phase Monitor & Coil Guard AF = Phase Monitor & Dirty Filter Switch AG = Coil Guard & Dirty Filter Switch AH = Phase Monitor, Coil Guard & Dirty Filter Switch	RC = Coil Guard, Shipping Bag & American Flag TA = Technicoat Condenser Coil TJ = Technicoat Evaporator Coil TS = Technicoat Evaporator & Condenser Coils

ZZ = If desired option combination is not listed above, ZZ will be assigned and configuration options will be located in digits 15-18.

Voltage
2 = 208/230-3-60
4 = 460-3-60
5 = 575-3-60

Airflow
A = Std. Motor
B = Std. Motor/Econo./Barometric Relief (Downflow Only)
C = Std. Motor/Econo./Power Exhaust (Downflow Only)
D = Std. Motor/Motorized Damper (Downflow Only)
E = Std. Motor/Horizontal Economizer (No Baro.)
F = Std. Motor/Slab Econo./Power Exhaust (Downflow Only)
G = Std. Motor/Slab Econo./Barometric Relief (Downflow Only)
N = Hi Static
P = Hi Static/Econo./Barometric Relief (Downflow Only)
Q = Hi Static/Econo./Power Exhaust (Downflow Only)
R = Hi Static/Motorized Damper (Downflow Only)
S = Hi Static/Horizontal Economizer (No Baro.)
T = Hi Static/Slab Econo./Power Exhaust (Downflow Only)
U = Hi Static/Slab Econo./Barometric Relief (Downflow only)

Installation Options
A = No Options Installed
B = Option 1
C = Option 2
D = Options 1 & 2
E = Option 3
F = Option 4
G = Options 1 & 3
H = Options 1 & 4
J = Options 1, 2 & 3
K = Options 1, 2, & 4
L = Options 1,3 & 4
M = Options 1, 2, 3, & 4
N = Options 2 & 3
P = Options 2 & 4
Q = Options 2, 3, & 4
R = Options 3 & 4
S = Option 5
T = Options 1 & 5
U = Options 1, 3, & 5
V = Options 1, 4, & 5
W = Options 1, 3, 4, & 5
X = Options 3 & 5
Y = Options 4 & 5
Z = Options 3, 4 & 5

Options
1 = Disconnect
2 = Non-Pwr'd Conv. Outlet
3 = Smoke Detector S.A.
4 = Smoke Detector R.A.
5 = Pwr'd Conv. Outlet

Installation

Installation Safety Information

Read these instructions before continuing this appliance installation. This is an outdoor combination heating and cooling unit. The installer must assure that these instructions are made available to the consumer and with instructions to retain them for future reference.

1. Refer to the unit rating plate for the approved type of gas for this product.
2. Install this unit only in a location and position as specified on Page 7 of these instructions.
3. Never test for gas leaks with an open flame. Use commercially available soap solution made specifically for the detection of leaks when checking all connections, as specified on Pages 5, 29, 30 and 48 of these instructions.
4. Always install furnace to operate within the furnace's intended temperature-rise range with the duct system and within the allowable external static pressure range, as specified on the unit name/rating plate, specified on Page 50 of these instructions.
5. This equipment is not to be used for temporary heating of buildings or structures under construction.

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

Preceding Installation

1. Remove the two screws holding the brackets in the front, rear and compressor side fork-lift slots.

Figure 1: Unit Shipping Bracket

2. Turn each bracket toward the ground and the protective plywood covering will drop to the ground.
3. Remove the condenser coil external protective covering prior to operation.
4. Remove the toolless doorknobs and instruction packet prior to installation.

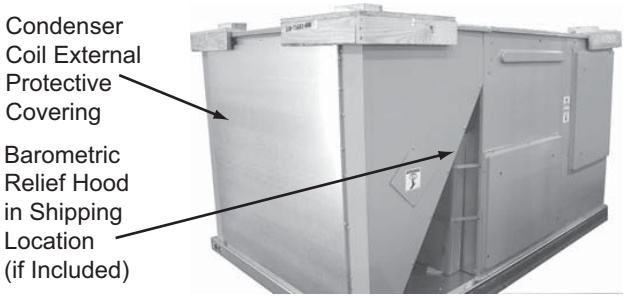


Figure 2: Condenser Covering

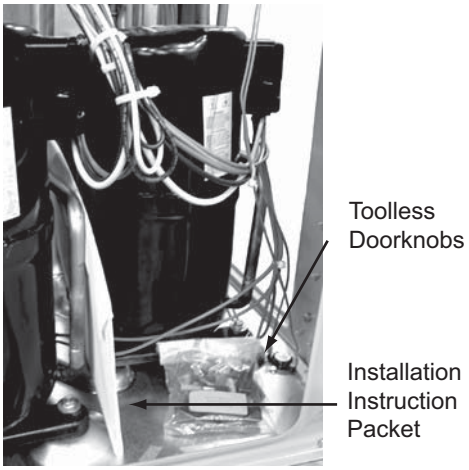


Figure 3: Compressor Section

5. If a factory option convenience outlet is installed, the weatherproof outlet cover must be field installed. The cover shall be located behind the filter access panel. To install the cover, remove the shipping label covering the convenience outlet, follow the instructions on the back of the weatherproof cover box, and attach the cover to the unit using the (4) screws provided.

⚠ CAUTION

208/230-3-60 and 380/415-3-50 units with factory installed Powered Convenience Outlet Option are wired for 230v and 415v power supply respectively. Change tap on transformer for 208-3-60 or 380-3-50 operation. See unit wiring diagram.

Limitations

These units must be installed in accordance with the following:

In U.S.A.:

1. National Electrical Code, ANSI/NFPA No. 70 - Latest Edition
2. National Fuel Gas Code, ANSI Z223.1 - Latest Edition
3. Gas-Fired Central Furnace Standard, ANSI Z21.47a. - Latest Edition
4. Local building codes, and
5. Local gas utility requirements

In Canada:

1. Canadian Electrical Code, CSA C22.1
2. Installation Codes, CSA - B149.1.
3. Local plumbing and waste water codes, and
4. Other applicable local codes.

Refer to unit application data found in this document.

After installation, gas fired units must be adjusted to obtain a temperature rise within the range specified on the unit rating plate.

If components are to be added to a unit to meet local codes, they are to be installed at the dealer's and/or customer's expense.

Size of unit for proposed installation should be based on heat loss/heat gain calculation made according to the methods of Air Conditioning Contractors of America (ACCA).

This furnace is not to be used for temporary heating of buildings or structures under construction.

⚠ CAUTION

The Simplicity® control board used in this product will effectively operate the cooling system down to 0°F when this product is applied in a comfort cooling application for people. An economizer is typically included in this type of application. When applying this product for process cooling applications (computer rooms, switchgear, etc.), please reference applications bulletin AE-011-07 or call the applications department for Unitary Products @ 1-877-UPG-SERV for guidance. Additional accessories may be needed for stable operation at temperatures below 30° F.

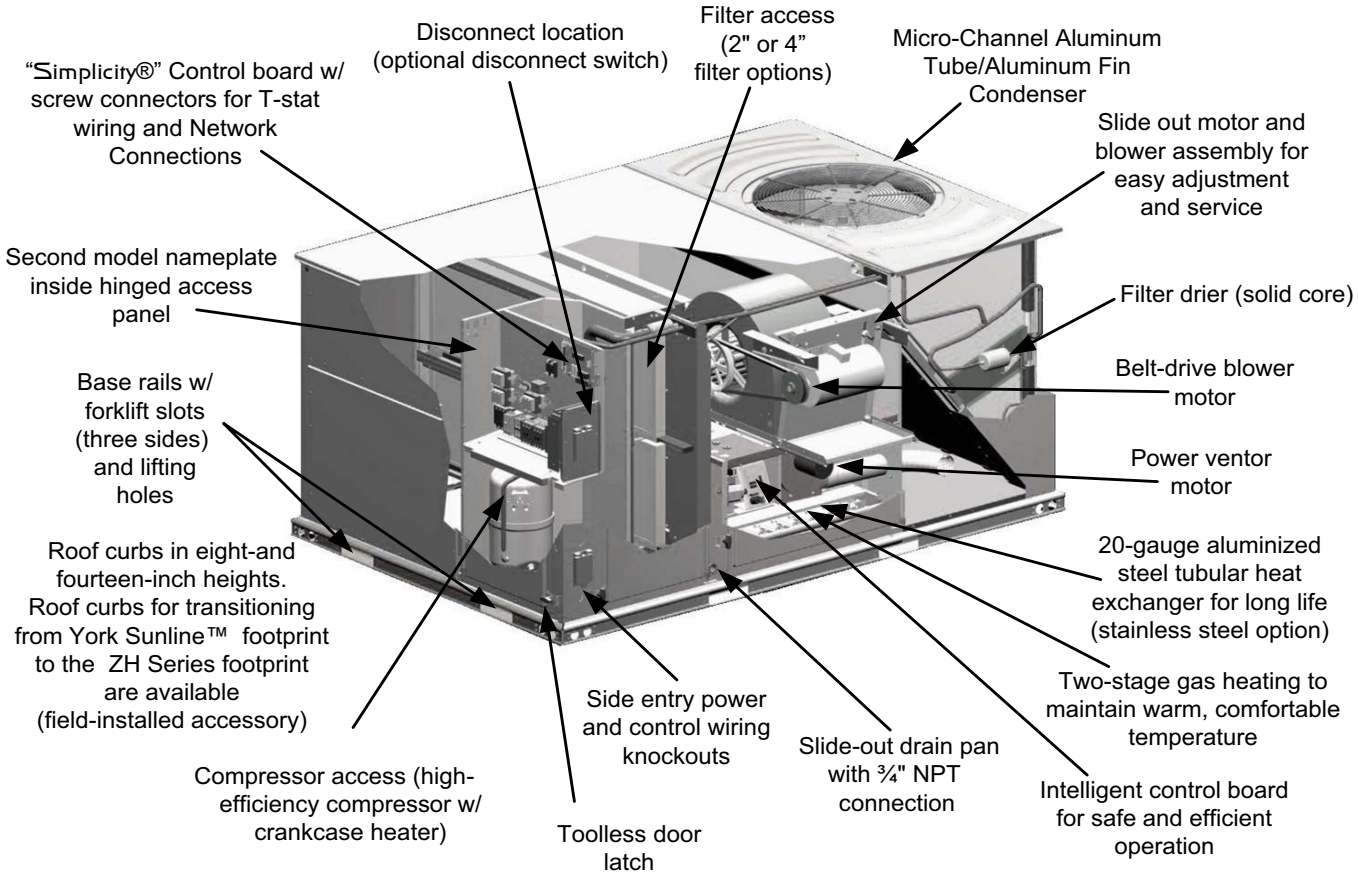

"Simplicity®" Control board w/ screw connectors for T-stat wiring and Network Connections
Disconnect location (optional disconnect switch)
Filter access (2" or 4" filter options)
Micro-Channel Aluminum Tube/Aluminum Fin Condenser
Slide out motor and blower assembly for easy adjustment and service
Second model nameplate inside hinged access panel
Filter drier (solid core)
Base rails w/ forklift slots (three sides) and lifting holes
Belt-drive blower motor
Power ventor motor
Roof curbs in eight-and fourteen-inch heights. Roof curbs for transitioning from York Sunline™ footprint to the ZH Series footprint are available (field-installed accessory)
20-gauge aluminized steel tubular heat exchanger for long life (stainless steel option)
Two-stage gas heating to maintain warm, comfortable temperature
Side entry power and control wiring knockouts
Slide-out drain pan with ¾" NPT connection
Intelligent control board for safe and efficient operation
Compressor access (high-efficiency compressor w/ crankcase heater)
Toolless door latch

Figure 4: Predator® Component Location (ZJ037 Shown)

Table 1: ZJ037-061 Unit Limitations

Size (Tons)	Model	Unit Voltage	Unit Limitations		
			Applied Voltage		Outdoor DB Temp
			Min	Max	Max (°F)
037 (3.0)	ZJ	208/230-3-60	187	252	125
		460-3-60	432	504	125
		575-3-60	540	630	125
049 (4.0)	ZJ	208/230-3-60	187	252	125
		460-3-60	432	504	125
		575-3-60	540	630	125
061 (5.0)	ZJ	208/230-3-60	187	252	125
		460-3-60	432	504	125
		575-3-60	540	630	125

Location

Use the following guidelines to select a suitable location for these units:

1. Unit is designed for *outdoor installation only*.
2. Condenser coils must have an unlimited supply of air. Where a choice of location is possible, position the unit on either north or east side of building.
3. Suitable for mounting on roof curb.
4. For ground level installation, use a level concrete slab with a minimum thickness of 4 inches. The length and width should be at least 6 inches greater than the unit base rails. Do not tie slab to the building foundation.
5. Roof structures must be able to support the weight of the unit and its options/accessories. Unit must be installed on a solid, level roof curb or appropriate angle iron frame.
6. Maintain level tolerance to 1/2” across the entire width and length of unit.

⚠WARNING

Excessive exposure of this furnace to contaminated combustion air may result in equipment damage or personal injury. Typical contaminates include: permanent wave solution, chlorinated waxes and cleaners, chlorine based swimming pool chemicals, water softening chemicals, carbon tetrachloride, Halogen type refrigerants, cleaning solvents (e.g. perchloroethylene), printing inks, paint removers, varnishes, hydrochloric acid, cements and glues, antistatic fabric softeners for clothes dryers, masonry acid washing materials.

Clearances

All units require particular clearances for proper operation and service. Installer must make provisions for adequate combustion and ventilation air in accordance with section 5.3 of Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 – Latest Edition (in U.S.A.), or Sections 7.2, 7.3, or 7.4 of Gas Installation Codes, CSA-B149.1 (in Canada) - Latest Edition, and/or applicable provisions of the local building codes. Refer to Table 5 for clearances required for combustible construction, servicing, and proper unit operation.

⚠WARNING

Do not permit overhanging structures or shrubs to obstruct condenser air discharge outlet, combustion air inlet or vent outlets.

Rigging And Handling

Exercise care when moving the unit. Do not remove any packaging until the unit is near the place of installation. Rig the unit by attaching chain or cable slings to the lifting holes provided in the base rails. Spreader bars, whose length exceeds the largest dimension across the unit, **MUST** be used across the top of the unit.

⚠ CAUTION

If a unit is to be installed on a roof curb other than a York® roof curb, gasketing must be applied to all surfaces that come in contact with the unit underside.

⚠ CAUTION

Before lifting, make sure the unit weight is distributed equally on the rigging cables so it will lift evenly.

Units may be moved or lifted with a forklift. Slotted openings in the base rails are provided for this purpose.

LENGTH OF FORKS MUST BE A MINIMUM OF 60 INCHES.

⚠ CAUTION

All panels must be secured in place when the unit is lifted.

The condenser coils should be protected from rigging cable damage with plywood or other suitable material.

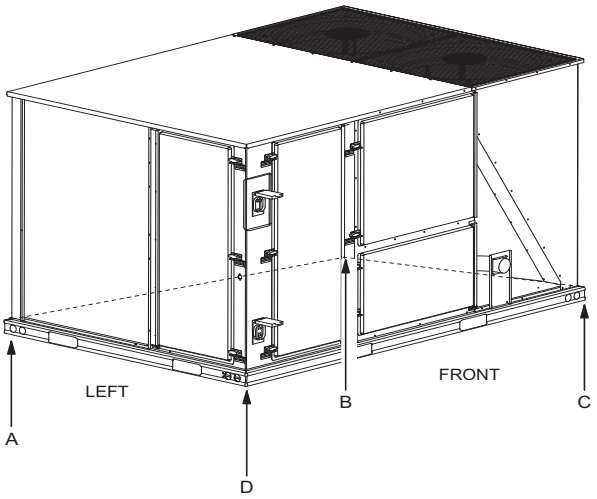


Figure 5: Unit 4 Point Load Weight

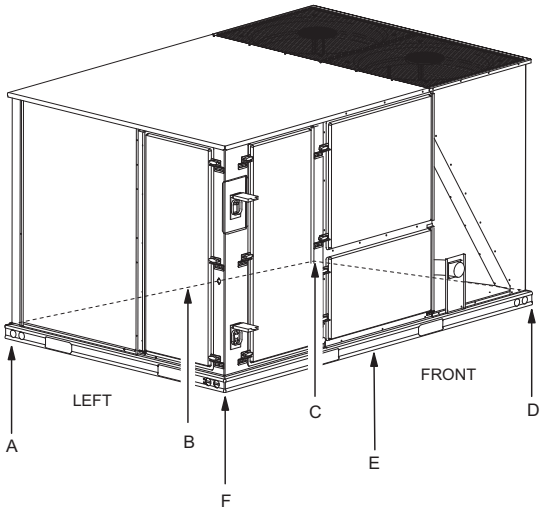


Figure 6: Unit 6 Point Load Weight

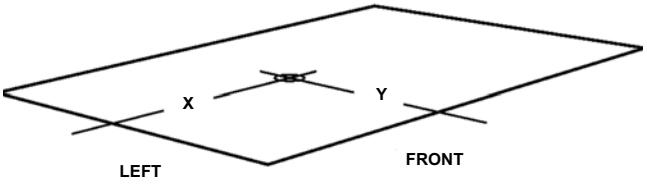


Figure 7: Center of Gravity

Table 2: Weights and Dimensions

Size (Tons)	Model	Weight (lbs.)		Center of Gravity		4 Point Load Location (lbs.)				6 Point Load Location (lbs.)					
		Shipping	Operating	X	Y	A	B	C	D	A	B	C	D	E	F
037 (3)	ZJ	745	740	40	26	180	147	186	228	124	108	95	120	137	157
049 (4)	ZJ	767	762	40	24	171	139	203	249	118	102	90	131	149	172
061 (5)	ZJ	775	770	40	24	172	141	205	251	119	103	91	132	151	174

Table 3: ZJ037-061 Unit Accessory Weights

Unit Accessory	Weight (lbs.)	
	Shipping	Operating
Economizer	90	85
Power Exhaust	40	35
Electric Heat[1]	49	49
Gas Heat[2]	110	110

1. Weight given is for the maximum heater size available (24KW).
2. Weight given is for the maximum number of tube heat exchangers available (8 tube).

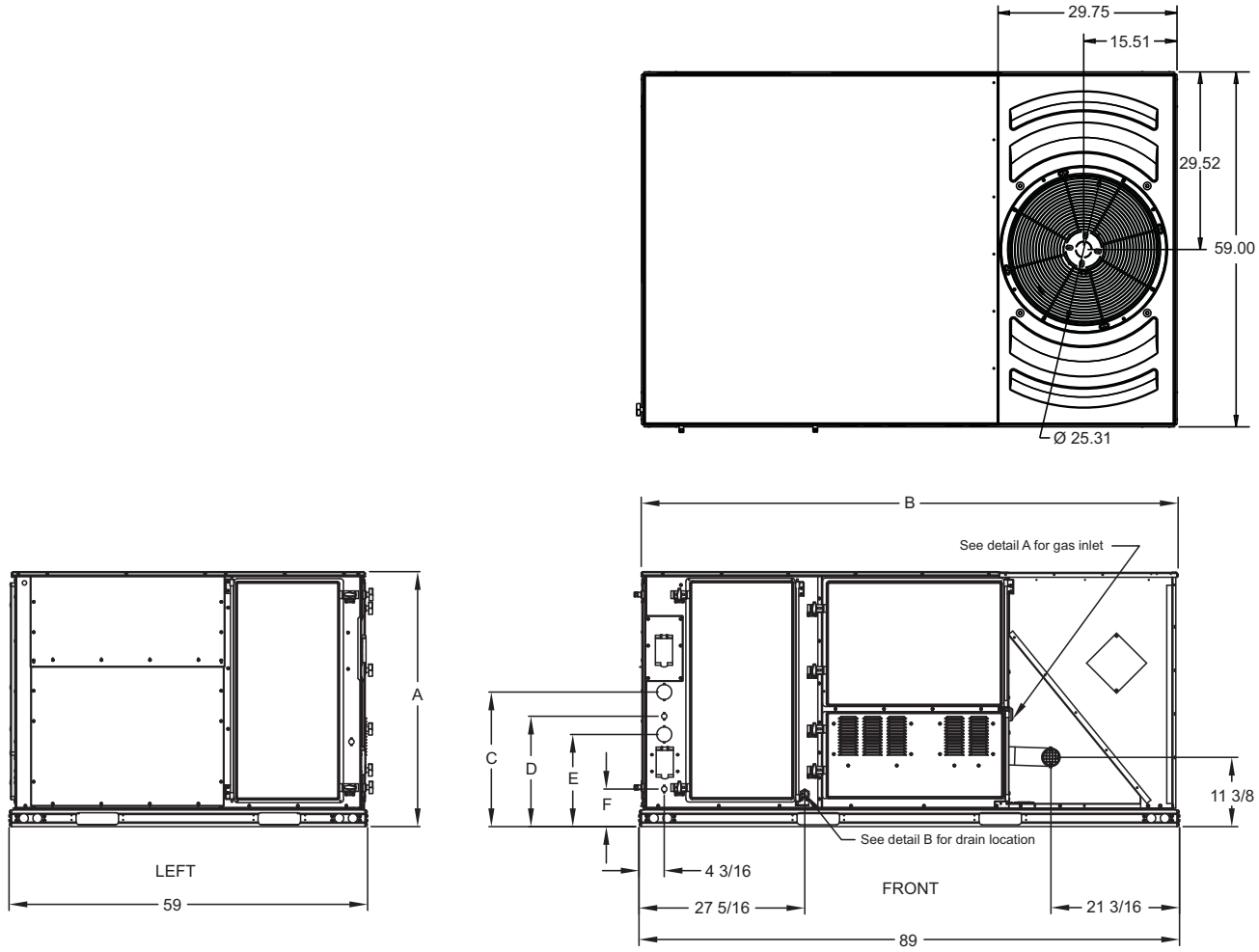


Figure 8: ZJ037 Physical Dimensions

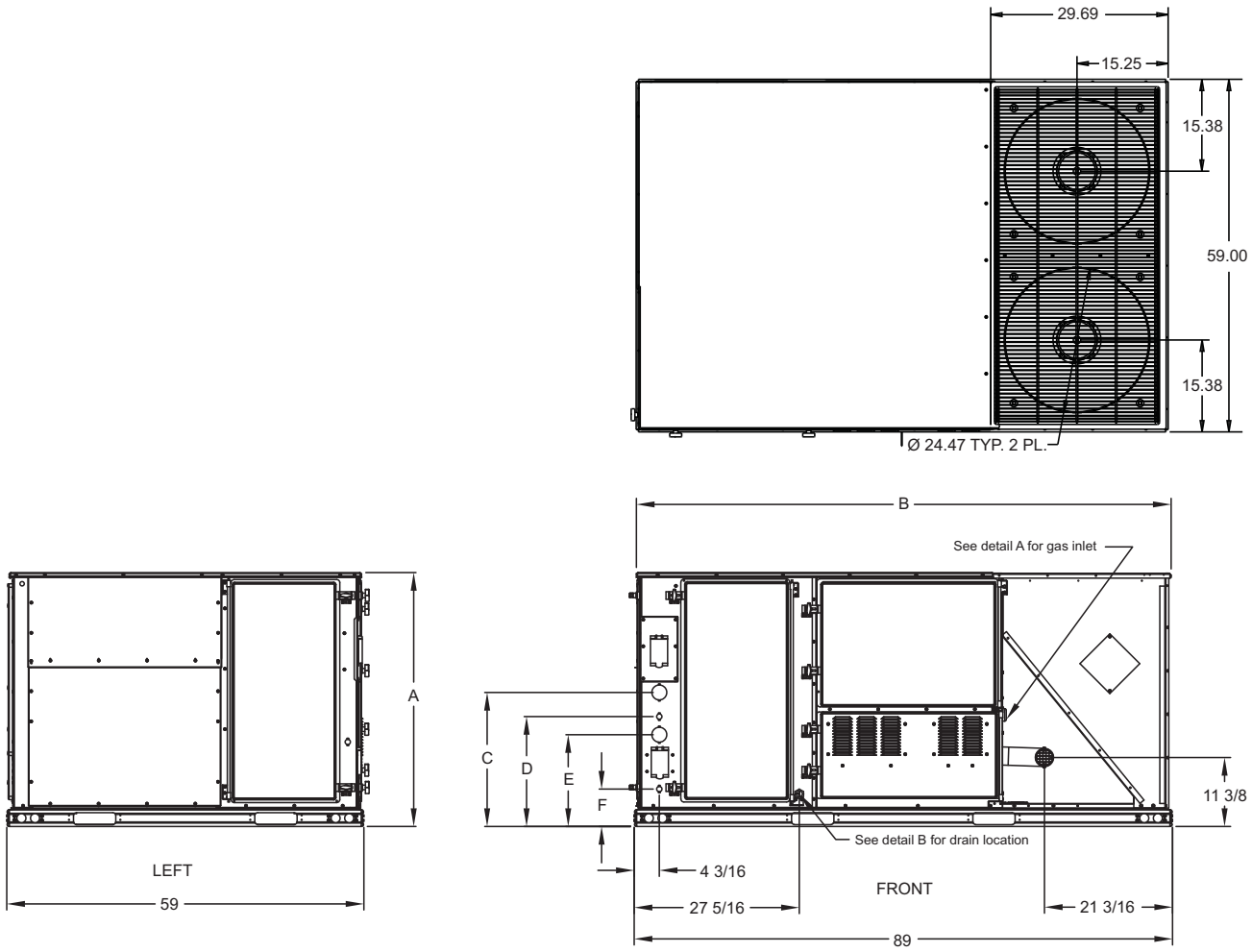
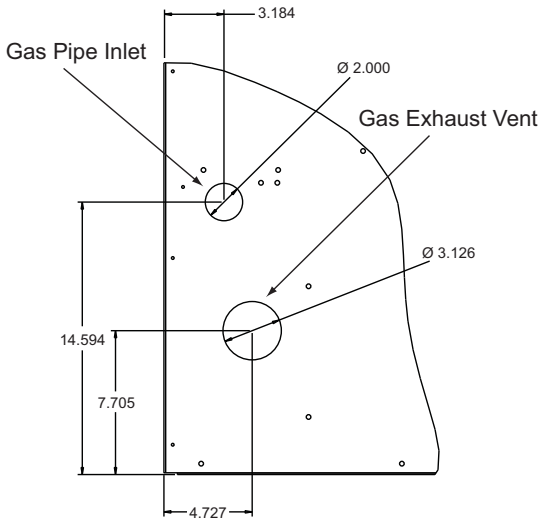


Figure 9: ZJ049-061 Physical Dimensions

Table 4: ZJ037-061 Unit Physical Dimensions

Unit Model Number	Dimension (in.)					
	A	B	C	D	E	F
ZJ037	42	89	22 1/8	18 3/16	15 3/16	6 3/16
ZJ049	42	89	22 1/8	18 3/16	15 3/16	6 3/16
ZJ061	42	89	22 1/8	18 3/16	15 3/16	6 3/16

Detail A



42" CABINET

Detail B

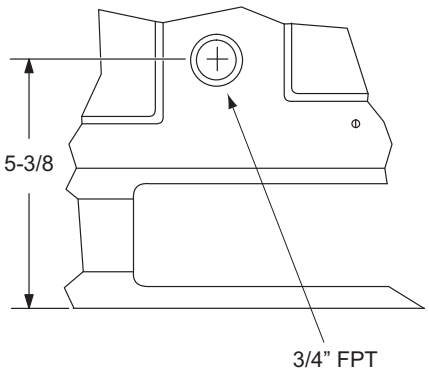


Table 5: ZJ037-061 Unit Clearances

Direction	Distance (in.)	Direction	Distance (in.)
Top[1]	72	Right	12
Front	36	Left	36
Rear	36	Bottom[2]	0

1. Units must be installed outdoors. Over hanging structure or shrubs should not obscure condenser air discharge outlet.
2. Units may be installed on combustable floors made from wood or class A, B or C roof covering materials.

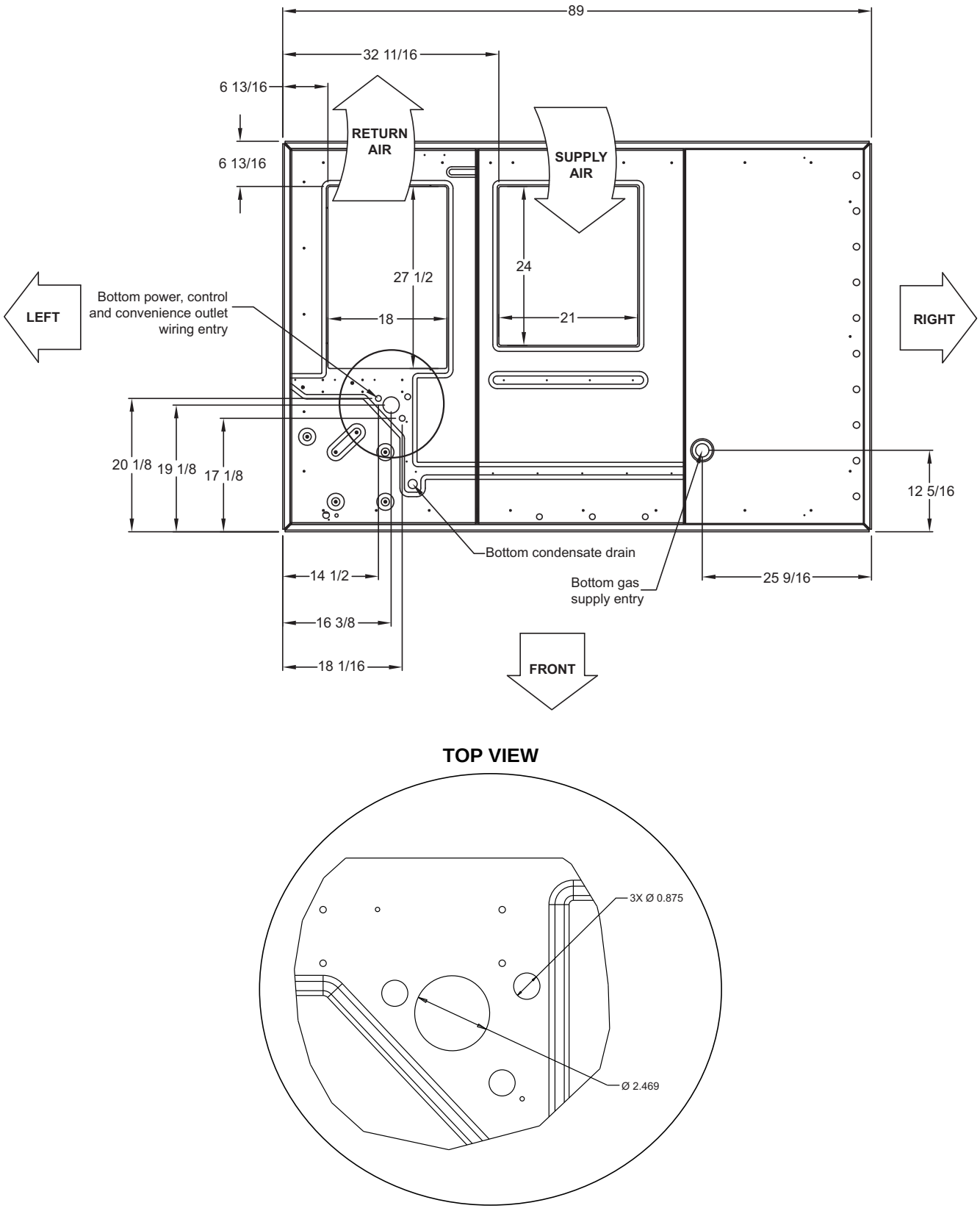


Figure 10: ZJ037-061 Unit Bottom Duct Openings

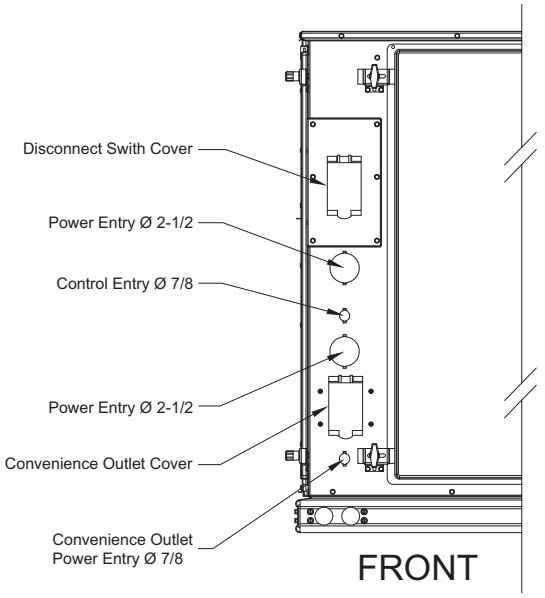


Figure 11: ZJ037-061 Unit Electrical Entry

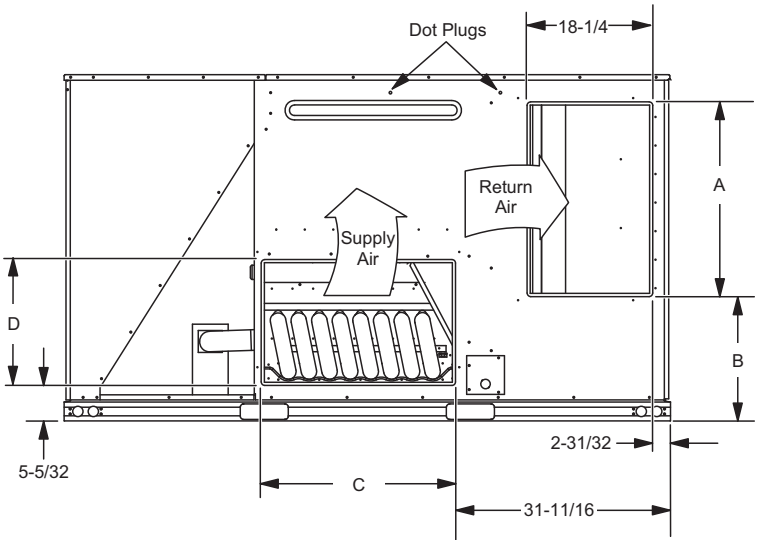


Figure 12: ZJ037-061 Unit Side Duct Openings

Table 6: Side Duct Dimensions

Unit Model Number	Dimension (in.)			
	A	B	C	D
ZJ037	27 3/4	12 1/16	27 1/2	16
ZJ049	27 3/4	12 1/16	27 1/2	16
ZJ061	27 3/4	12 1/16	27 1/2	16

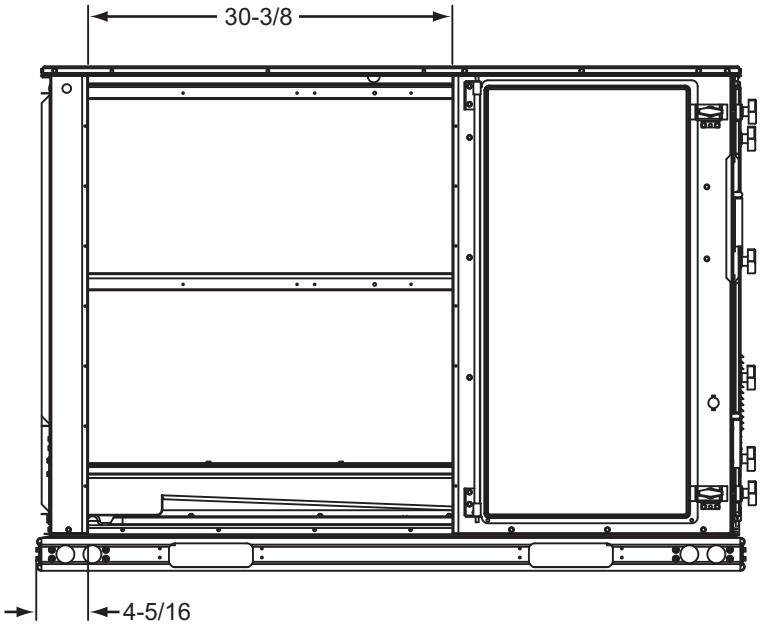


Figure 13: ZJ037-061 Unit Left Duct Opening

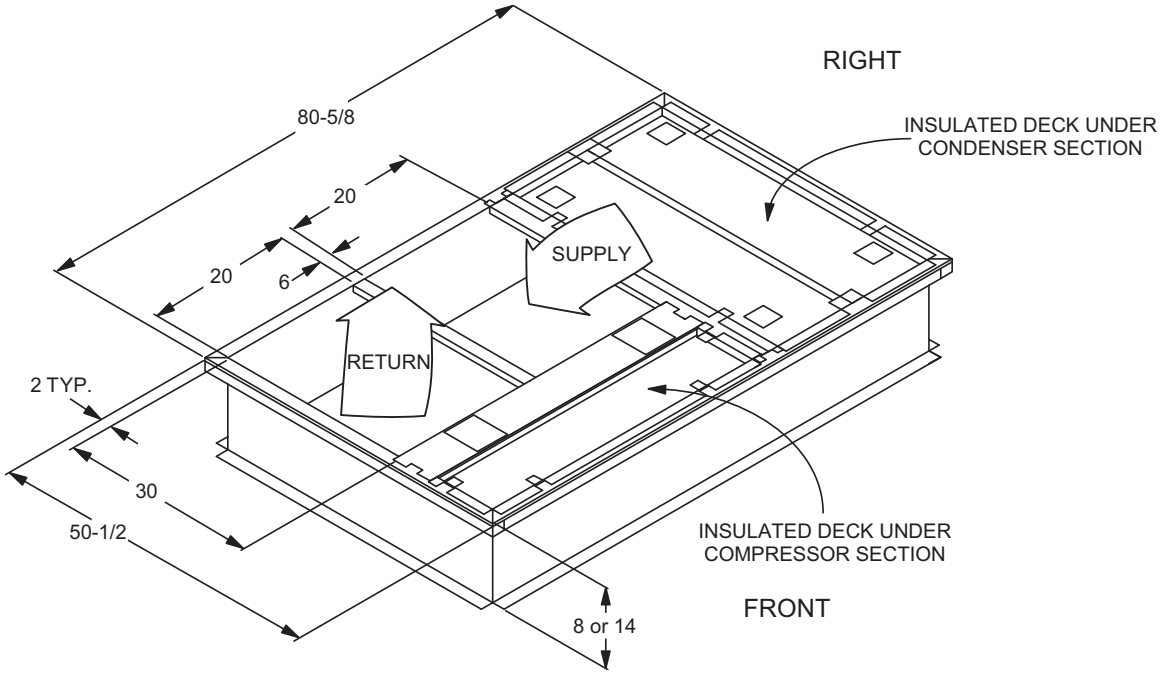


Figure 14: ZJ037-061 Roof Curb

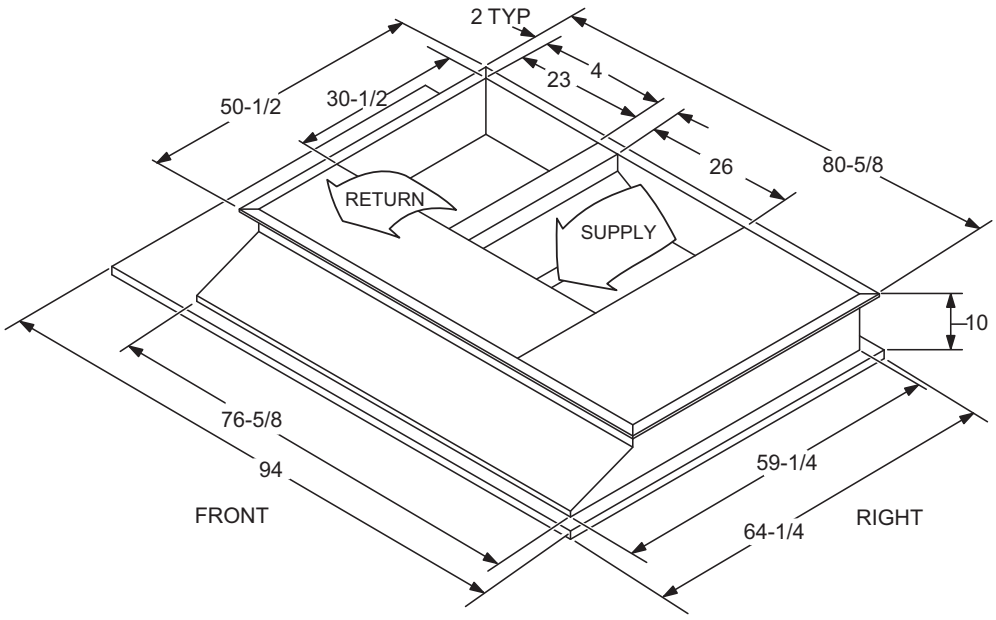


Figure 15: ZJ037-061 Transition Roof Curb

Ductwork

Ductwork should be designed and sized according to the methods in Manual D of the Air Conditioning Contractors of America (ACCA) or as recommended by any other recognized authority such as ASHRAE or SMACNA.

A closed return duct system should be used. This will not preclude use of economizers or outdoor fresh air intake. The supply and return air duct connections at the unit should be made with flexible joints to minimize noise.

The supply and return air duct systems should be designed for the CFM and static pressure requirements of the job. They should NOT be sized to match the dimensions of the duct connections on the unit.

Refer to Figure 10 for bottom air duct openings. Refer to Figures 12, 13 and Table 6 for side air duct openings.

Duct Covers

Units are shipped with the side duct openings covered and a covering over the bottom of the unit. For bottom duct application, no duct cover changes are necessary. For side duct application, remove the side duct covers and install over the bottom duct openings. The panels removed from the side duct connections are designed to be reused by securing each panel to its respective downflow opening. But keep in mind that the supply panel is installed with the painted surface UP, facing the heat exchanger, while the return panel is installed with the painted surface DOWN, facing the downflow duct opening. The supply panel is secured with the bracket (already in place from the factory) and two screws. It's a snug fit for the panel when sliding it between the heat exchanger and unit bottom, but there is room. The return panel is secured with four screws.

⚠ CAUTION

When fastening ductwork to side duct flanges on unit, insert screws through duct flanges only. DO NOT insert screws through casing. Outdoor ductwork must be insulated and water-proofed.

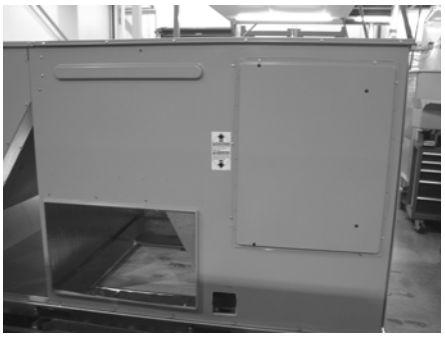


Figure 16: Side Panels With Hole Plugs

NOTE: Orientation. Panel is "insulation" side up.

Figure 17: Return Downflow Plenum With Panel

Figure 18: Discharge Panel In Place

Condensate Drain

The side condensate drain is reversible and maybe re-oriented to the rear of the cabinet to facilitate condensate piping. A condensate drain connection is available through the base pan for piping inside the roof curb. Trap the connection per Figure 19. The trap and drain lines should be protected from freezing.

Plumbing must conform to local codes. Use a sealing compound on male pipe threads. Install condensate drain line from the 3/4 inch NPT female connection on the unit to an open drain.

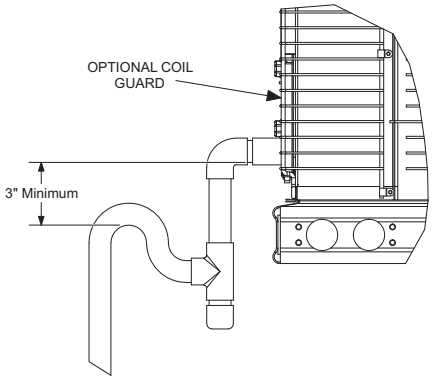


Figure 19: Condensate Drain

Compressors

The scroll compressor used in this product is specifically designed to operate with R-410A Refrigerant and cannot be interchanged.

⚠ CAUTION

This system uses R-410A Refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system.

The compressor also uses a polyolester (POE oil), Mobil 3MA POE. This oil is extremely hygroscopic, meaning it absorbs water readily. POE oil can absorb 15 times as much water as other oils designed for HCFC and CFC refrigerants. Take all necessary precautions to avoid exposure of the oil to the atmosphere.

⚠ CAUTION

Do not leave the system open to the atmosphere. Unit damage could occur due to moisture being absorbed by the **POE oil** in the system. This type of oil is highly susceptible to moisture absorption

POE (polyolester) compressor lubricants are known to cause long term damage to some synthetic roofing materials.

⚠ CAUTION

Exposure, even if immediately cleaned up, may cause embrittlement (leading to cracking) to occur in one year or more. When performing any service that may risk exposure of compressor oil to the roof, take precautions to protect roofing.

Procedures which risk oil leakage include, but are not limited to, compressor replacement, repairing refrigerant leaks, replacing refrigerant components such as filter drier, pressure switch, metering device or coil.

Units are shipped with compressor mountings which are factory-adjusted and ready for operation.

⚠ CAUTION

Do not loosen compressor mounting bolts.

Filters

Two-inch filters are supplied with each unit. One-inch filters may be used with no modification to the filter racks. Filters must always be installed ahead of evaporator coil and must be kept clean or replaced with same size and type. Dirty filters reduce the capacity of the unit and result in frosted coils or safety shutdown. Refer to physical data tables, for the number and size of filters needed for the unit. The unit should not be operated without filters properly installed.

⚠ CAUTION

Make sure that panel latches are properly positioned on the unit to maintain an airtight seal.

Power And Control Wiring

Field wiring to the unit, fuses, and disconnects must conform to provisions of National Electrical Code (NEC), ANSI/NFPA No. 70 – Latest Edition (in U.S.A.), current Canadian Electrical Code C221, and/or local ordinances. The unit must be electrically grounded in accordance with NEC and CEC as specified above and/or local codes.

Voltage tolerances which must be maintained at the compressor terminals during starting and running conditions are indicated on the unit Rating Plate and Table 1.

⚠ CAUTION

208/230-3-60 and 380/415-3-50 units control transformers are factory wired for 230v and 415v power supply respectively. Change tap on transformer for 208-3-60 or 380-3-50 operation. See unit wiring diagram.

The internal wiring harnesses furnished with this unit are an integral part of the design certified unit. Field alteration to comply with electrical codes should not be required. If any of the wire supplied with the unit must be replaced, replacement wire must be of the type shown on the wiring diagram and the same minimum gauge as the replaced wire.

A disconnect must be utilized for these units. Factory installed disconnects are available. If installing a disconnect (field supplied or York International® supplied accessory), refer to Figure 4 for the recommended mounting location.

⚠ CAUTION

Avoid damage to internal components if drilling holes for disconnect mounting.

NOTE: Since not all local codes allow the mounting of a disconnect on the unit, please confirm compliance with local code before mounting a disconnect on the unit.

Electrical line must be sized properly to carry the load. USE COPPER CONDUCTORS ONLY. Each unit must be wired with a separate branch circuit fed directly from the meter panel and properly fused.

Refer to Figures 20 and 21 for typical field wiring and to the appropriate unit wiring diagram mounted inside control doors for control circuit and power wiring information.

⚠ CAUTION

When connecting electrical power and control wiring to the unit, water-proof connectors must be used so that water or moisture cannot be drawn into the unit during normal operation. The above water-proofing conditions will also apply when installing a field supplied disconnect switch.

Power Wiring Detail

Units are factory wired for the voltage shown on the unit nameplate. Refer to Electrical Data Table 8 to size power wiring, fuses, and disconnect switch.

Power wiring is brought into the unit through the side of the unit or the basepan inside the curb.

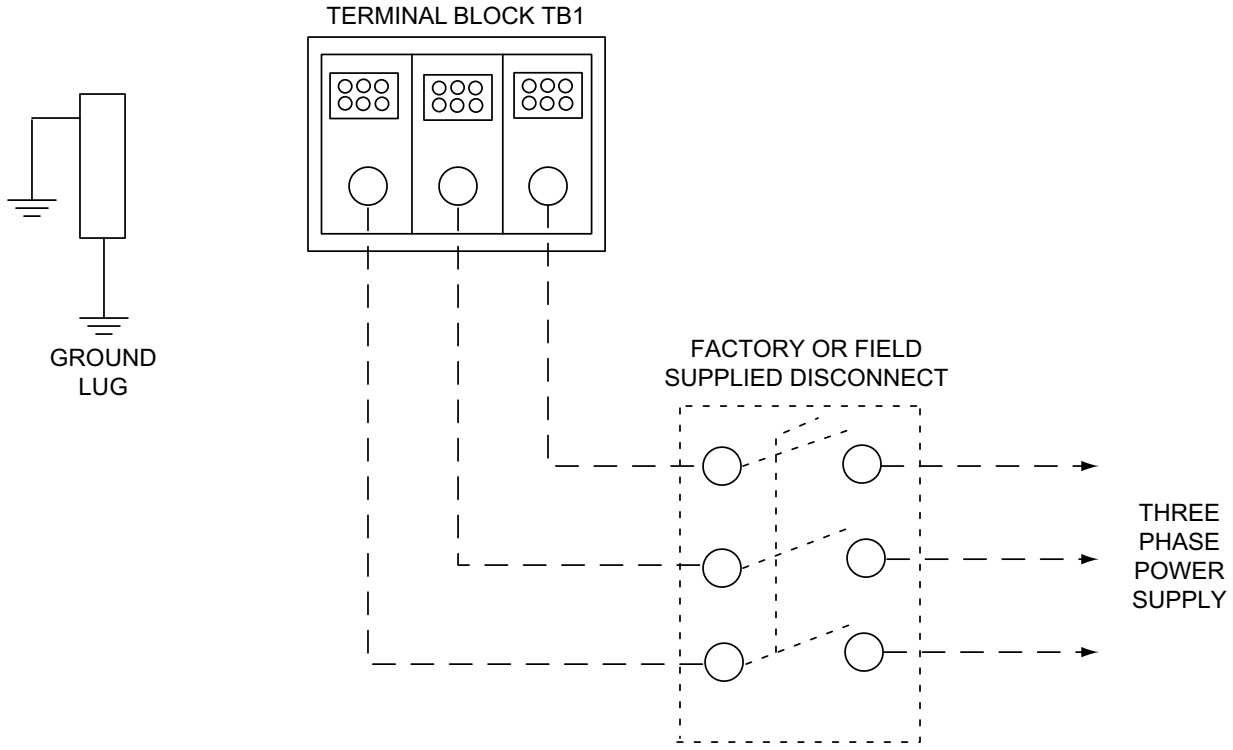


Figure 20: Field Wiring Disconnect

Thermostat Wiring

The thermostat should be located on an inside wall approximately 56 inch above the floor where it will not be subject to drafts, sun exposure or heat from electrical fixtures or appliances. Follow the manufacturer's instructions enclosed with thermostat for general installation procedure. Seven (7) color-coded, insulated wires should be used to connect the thermostat to the unit. Refer to Table 7 for control wire sizing and maximum length.

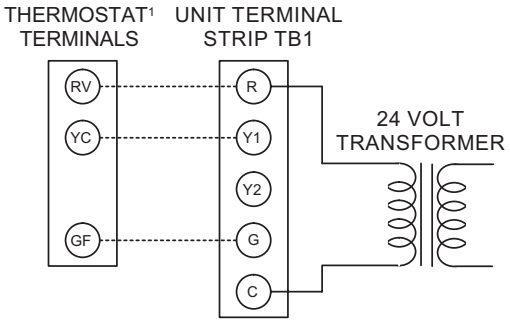
Table 7: Control Wire Sizes

Wire Size	Maximum Length[1]
18 AWG	150 Feet

1. From the unit to the thermostat and back to the unit.

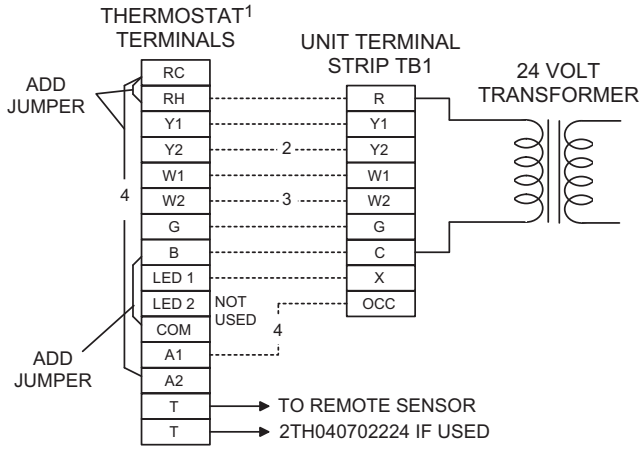
Typical Control Wiring Detail

COOLING ONLY (24 VOLT THERMOSTAT)



[1]24 VOLT THERMOSTAT 2TH07701024. TO CONTROL THE ECONOMIZER ON SECOND STAGE COOLING, USE THE THERMOSTAT 2TH0401224.

COOLING / HEATING (ELECTRONIC THERMOSTAT) MULTI STAGE



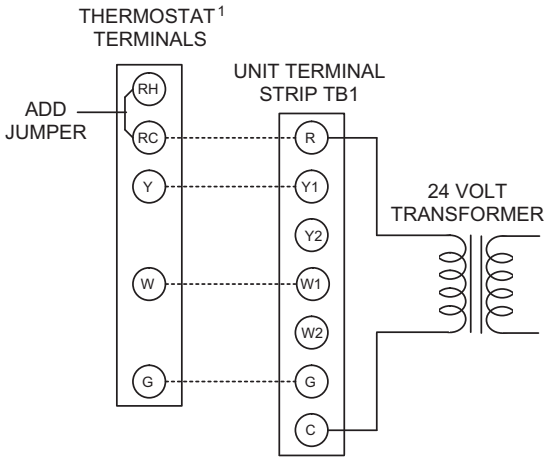
[1] ELECTRONIC PROGRAMMABLE THERMOSTAT 2ET04700224 (INCLUDES SUBBASE).

[2] SECOND STAGE COOLING IS NOT REQUIRED ON UNITS LESS ECONOMIZER.

[3] SECOND STAGE HEATING IS ONLY REQUIRED ON UNITS WITH A TWO STAGE ELECTRIC HEATER OR 2 STAGE GAS HEAT.

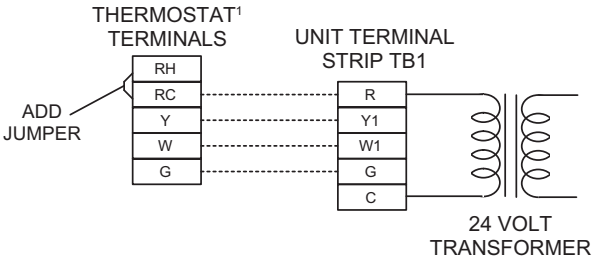
[4] REMOVE JUMPER J2 FROM TERMINALS 4 AND 9 ON JUMPER PLUG CONNECTOR P6 ON UNITS WITH ECONOMIZER. TERMINALS A1 AND A2 PROVIDE A RELAY OUT-PUT TO CLOSE THE OUTDOOR ECONOMIZER DAMPERS WHEN THE THERMOSTAT SWITCHES TO THE SET-BACK POSITION.

COOLING / HEATING (24 VOLT THERMOSTAT)



[1]24 VOLT THERMOSTAT 2ET07701024. TO CONTROL THE ECONOMIZER ON THE SECOND STAGE COOLING OR TO HAVE AN ELECTRIC HEAT ACCESSORY WITH TWO STAGES OF HEAT, USE THERMOSTAT 2TH0471024.

COOLING / HEATING (ELECTRONIC THERMOSTAT) SINGLE STAGE



[1]ELECTRONIC PROGRAMMABLE THERMOSTAT 2ET07701024 (INCLUDES SUBBASE). TO CONTROL THE ECONOMIZER ON SECOND STAGE COOLING, USE THERMOSTAT 2TH04700224.

Figure 21: Typical Control Wiring

Table 8: Electrical Data

ZJ037-061 Standard Indoor Blower - Without Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
037 (3)	208	8.7	68	13.5	1.5	6.0	5.5	0.0	None	-	-	-	18.4	23.9	25	30
									E03	2.3	1	6.4	18.4	23.9	25	30
									E06	4.5	1	12.5	23.1	30	25	30
									E08	6.8	1	18.9	31.1	38	35	40
									E15	11.3	2	31.4	46.7	53.6	50	60
	230	8.7	68	13.5	1.5	6.0	5.5	0.0	None	-	-	-	18.4	23.9	25	30
									E03	3	1	7.5	18.4	23.9	25	30
									E06	6	1	15.1	25.5	32.4	30	35
									E08	9	1	22.6	34.6	41.4	35	45
									E15	15	2	37.7	52.6	59.5	60	60
	460	4.6	34	7.1	0.8	3.0	2.2	0.0	None	-	-	-	9.6	11.8	15	15
									E03	3	1	3.8	9.6	11.8	15	15
									E06	6	1	7.5	12.8	15.5	15	20
									E08	9	1	11.3	17.3	20	20	20
									E15	15	2	18.8	26.3	29.1	30	30
	575	3.5	28	5.5	0.6	2.4	1.8	0.0	None	-	-	-	7.4	9.2	15	15
									E08	9	1	9.0	13.8	16.1	15	20
									E15	15	2	15.1	21	23.3	25	25
049 (4)	208	11.9	88	18.5	1.5	6.0	5.5	0.0	None	-	-	-	23.9	29.4	30	40
									E06	4.5	1	12.5	23.9	30	30	40
									E08	6.8	1	18.9	31.1	38	35	40
									E15	11.3	2	31.4	46.7	53.6	50	60
									E20	15	2	41.6	59.5	66.4	60	70
	230	11.9	88	18.5	1.5	6.0	5.5	0.0	None	-	-	-	23.9	29.4	30	40
									E06	6	1	15.1	25.5	32.4	35	40
									E08	9	1	22.6	34.6	41.4	35	45
									E15	15	2	37.7	52.6	59.5	60	60
									E20	20	2	50.2	67.6	74.5	70	80
	460	5.2	44	8.1	0.8	3.0	2.2	0.0	None	-	-	-	11.1	13.3	15	15
									E06	6	1	7.5	12.8	15.5	15	20
									E08	9	1	11.3	17.3	20	20	20
									E15	15	2	18.8	26.3	29.1	30	30
									E20	20	2	25.1	33.8	36.6	35	40
	575	4.8	36	7.5	0.66	2.4	1.8	0.0	None	-	-	-	9.6	11.4	15	15
									E08	9	1	9.0	13.8	16.1	15	20
									E15	15	2	15.1	21	23.3	25	25
									E20	20	2	20.1	27.1	29.3	30	30
061 (5)	208	14.1	88	22	1.5	6.0	5.5	0.0	None	-	-	-	26.6	32.1	35	45
									E06	4.5	1	12.5	26.6	32.1	35	45
									E08	6.8	1	18.9	31.1	38	40	45
									E15	11.3	2	31.4	46.7	53.6	50	60
									E20	15	2	41.6	59.5	66.4	60	70
									E23	18	2	50.0	70	76.8	70	80
	230	14.1	88	22	1.5	6.0	5.5	0.0	None	-	-	-	26.6	32.1	35	45
									E06	6	1	15.1	26.6	32.4	35	45
									E08	9	1	22.6	34.6	41.4	40	45
									E15	15	2	37.7	52.6	59.5	60	60
									E20	20	2	50.2	67.6	74.5	70	80
									E23	24	2	60.2	79.7	86.5	80	90
	460	7.7	55	12	0.8	3.0	2.2	0.0	None	-	-	-	14.2	16.4	20	20
									E06	6	1	7.5	14.2	16.4	20	20
									E08	9	1	11.3	17.3	20	20	20
									E15	15	2	18.8	26.3	29.1	30	30
									E20	20	2	25.1	33.8	36.6	35	40
									E23	24	2	30.1	39.8	42.6	40	45
	575	5.1	36	7.5	0.6	2.4	1.8	0.0	None	-	-	-	10	11.8	15	15
									E08	9	1	9.0	13.8	16.1	15	20
									E15	15	2	15.1	21	23.3	25	25
									E20	20	2	20.1	27.1	29.3	30	30
									E23	24	2	24.1	31.9	34.1	35	35

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

ZJ037-061 Hi Static Indoor Blower - Without Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
037 (3)	208	8.7	68	13.5	1.5	6.0	5.5	0.0	None	-	-	-	18.4	23.9	25	30
									E03	2.3	1	6.4	18.4	23.9	25	30
									E06	4.5	1	12.5	23.1	30	25	30
									E08	6.8	1	18.9	31.1	38	35	40
									E15	11.3	2	31.4	46.7	53.6	50	60
	230	8.7	68	13.5	1.5	6.0	5.5	0.0	None	-	-	-	18.4	23.9	25	30
									E03	3	1	7.5	18.4	23.9	25	30
									E06	6	1	15.1	25.5	32.4	30	35
									E08	9	1	22.6	34.6	41.4	35	45
									E15	15	2	37.7	52.6	59.5	60	60
	460	4.6	34	7.1	0.8	3.0	2.2	0.0	None	-	-	-	9.6	11.8	15	15
									E03	3	1	3.8	9.6	11.8	15	15
									E06	6	1	7.5	12.8	15.5	15	20
									E08	9	1	11.3	17.3	20	20	20
									E15	15	2	18.8	26.3	29.1	30	30
	575	3.5	28	5.5	0.6	2.4	1.8	0.0	None	-	-	-	7.4	9.2	15	15
									E08	9	1	9.0	13.8	16.1	15	20
									E15	15	2	15.1	21	23.3	25	25
049 (4)	208	11.9	88	18.5	1.5	6.0	5.5	0.0	None	-	-	-	23.9	29.4	30	40
									E06	4.5	1	12.5	23.9	30	30	40
									E08	6.8	1	18.9	31.1	38	35	40
									E15	11.3	2	31.4	46.7	53.6	50	60
									E20	15	2	41.6	59.5	66.4	60	70
	230	11.9	88	18.5	1.5	6.0	5.5	0.0	None	-	-	-	23.9	29.4	30	40
									E06	6	1	15.1	25.5	32.4	35	40
									E08	9	1	22.6	34.6	41.4	35	45
									E15	15	2	37.7	52.6	59.5	60	60
									E20	20	2	50.2	67.6	74.5	70	80
	460	5.2	44	8.1	0.8	3.0	2.2	0.0	None	-	-	-	11.1	13.3	15	15
									E06	6	1	7.5	12.8	15.5	15	20
									E08	9	1	11.3	17.3	20	20	20
									E15	15	2	18.8	26.3	29.1	30	30
									E20	20	2	25.1	33.8	36.6	35	40
	575	4.8	36	7.5	0.6	2.4	1.8	0.0	None	-	-	-	9.6	11.4	15	15
									E08	9	1	9.0	13.8	16.1	15	20
									E15	15	2	15.1	21	23.3	25	25
									E20	20	2	20.1	27.1	29.3	30	30
061 (5)	208	14.1	88	22	1.5	6.8	5.5	0.0	None	-	-	-	27.4	32.9	35	45
									E06	4.5	1	12.5	27.4	32.9	35	45
									E08	6.8	1	18.9	32.1	39	40	45
									E15	11.3	2	31.4	47.7	54.6	50	60
									E20	15	2	41.6	60.5	67.4	70	70
									E23	18	2	50.0	71	77.8	80	80
	230	14.1	88	22	1.5	6.8	5.5	0.0	None	-	-	-	27.4	32.9	35	45
									E06	6	1	15.1	27.4	33.4	35	45
									E08	9	1	22.6	35.6	42.4	40	45
									E15	15	2	37.7	53.6	60.5	60	70
									E20	20	2	50.2	68.6	75.5	70	80
									E23	24	2	60.2	80.7	87.5	90	90
	460	7.7	55	12	0.8	3.4	2.2	0.0	None	-	-	-	14.6	16.8	20	20
									E06	6	1	7.5	14.6	16.8	20	20
									E08	9	1	11.3	17.8	20.5	20	25
									E15	15	2	18.8	26.8	29.6	30	30
									E20	20	2	25.1	34.3	37.1	35	40
									E23	24	2	30.1	40.3	43.1	45	45
	575	5.1	36	7.5	0.6	2.7	1.8	0.0	None	-	-	-	10.3	12.1	15	15
									E08	9	1	9.0	14.2	16.5	15	20
									E15	15	2	15.1	21.4	23.7	25	25
									E20	20	2	20.1	27.4	29.7	30	30
									E23	24	2	24.1	32.2	34.5	35	35

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

ZH037-061 Standard Indoor Blower - With Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
037 (3)	208	9.1	68	14.2	1.5	6.0	5.5	10.0	None	-	-	-	29.1	34.6	35	40
									E03	2.3	1	6.4	29.1	34.9	35	40
									E06	4.5	1	12.5	35.6	42.5	40	45
									E08	6.8	1	18.9	43.6	50.5	45	60
									E15	11.3	2	31.4	59.2	66.1	60	70
	230	9.1	68	14.2	1.5	6.0	5.5	10.0	None	-	-	-	29.1	34.6	35	40
									E03	3	1	7.5	29.1	35.9	35	40
									E06	6	1	15.1	38	44.9	40	45
									E08	9	1	22.6	47.1	53.9	50	60
									E15	15	2	37.7	65.1	72	70	80
	460	4.5	34	7	0.8	3.0	2.2	5.0	None	-	-	-	14.6	16.8	15	20
									E03	3	1	3.8	14.6	17.3	15	20
									E06	6	1	7.5	19	21.8	20	25
									E08	9	1	11.3	23.5	26.3	25	30
									E15	15	2	18.8	32.6	35.3	35	40
	575	3.8	28	6	0.6	2.4	1.8	4.0	None	-	-	-	11.8	13.6	15	15
									E08	9	1	9.0	18.8	21.1	20	25
									E15	15	2	15.1	26	28.3	30	30
049 (4)	208	16	120	25	1.5	6.0	5.5	10.0	None	-	-	-	37.5	43	50	50
									E06	4.5	1	12.5	37.5	43	50	50
									E08	6.8	1	18.9	43.6	50.5	50	60
									E15	11.3	2	31.4	59.2	66.1	60	70
									E20	15	2	41.6	72	78.9	80	80
	230	16	120	25	1.5	6.0	5.5	10.0	None	-	-	-	37.5	43	50	50
									E06	6	1	15.1	38	44.9	50	50
									E08	9	1	22.6	47.1	53.9	50	60
									E15	15	2	37.7	65.1	72	70	80
									E20	20	2	50.2	80.1	87	90	90
	460	7.7	50	12	0.8	3.0	2.2	5.0	None	-	-	-	18.4	20.6	25	25
									E06	6	1	7.5	19	21.8	25	25
									E08	9	1	11.3	23.5	26.3	25	30
									E15	15	2	18.8	32.6	35.3	35	40
									E20	20	2	25.1	40.1	42.8	45	45
	575	6.4	40	10	0.6	2.4	1.8	4.0	None	-	-	-	15	16.8	20	20
									E08	9	1	9.0	18.8	21.1	20	25
									E15	15	2	15.1	26	28.3	30	30
									E20	20	2	20.1	32.1	34.3	35	35
061 (5)	208	13.9	110	21.7	1.5	6.0	5.5	10.0	None	-	-	-	34.9	40.4	45	50
									E06	4.5	1	12.5	35.6	42.5	45	50
									E08	6.8	1	18.9	43.6	50.5	45	60
									E15	11.3	2	31.4	59.2	66.1	60	70
									E20	15	2	41.6	72	78.9	80	80
									E23	18	2	50.0	82.5	89.3	90	90
	230	13.9	110	21.7	1.5	6.0	5.5	10.0	None	-	-	-	34.9	40.4	45	50
									E06	6	1	15.1	38	44.9	45	50
									E08	9	1	22.6	47.1	53.9	50	60
									E15	15	2	37.7	65.1	72	70	80
									E20	20	2	50.2	80.1	87	90	90
									E23	24	2	60.2	92.2	99	100	100
	460	7.4	55	11.5	0.8	3.0	2.2	5.0	None	-	-	-	18.1	20.3	25	25
									E06	6	1	7.5	19	21.8	25	25
									E08	9	1	11.3	23.5	26.3	25	30
									E15	15	2	18.8	32.6	35.3	35	40
									E20	20	2	25.1	40.1	42.8	45	45
									E23	24	2	30.1	46.1	48.8	50	50
	575	5.6	43	8.7	0.6	2.4	1.8	4.0	None	-	-	-	14	15.8	15	20
									E08	9	1	9.0	18.8	21.1	20	25
									E15	15	2	15.1	26	28.3	30	30
									E20	20	2	20.1	32.1	34.3	35	35
									E23	24	2	24.1	36.9	39.1	40	40

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

ZJ037-061 Hi Static Blower - With Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Exh Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	MCA[1] w/Pwr Exh (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)	Max Fuse[2]/ Breaker[3] Size w/ Pwr Exh (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	FLA	Model	kW	Stages	Amps				
037 (3)	208	8.7	68	13.5	1.5	6.0	5.5	10.0	None	-	-	-	28.7	34.2	35	40
									E03	2.3	1	6.4	28.7	34.9	35	40
									E06	4.5	1	12.5	35.6	42.5	40	45
									E08	6.8	1	18.9	43.6	50.5	45	60
									E15	11.3	2	31.4	59.2	66.1	60	70
	230	8.7	68	13.5	1.5	6.0	5.5	10.0	None	-	-	-	28.7	34.2	35	40
									E03	3	1	7.5	29	35.9	35	40
									E06	6	1	15.1	38	44.9	40	45
									E08	9	1	22.6	47.1	53.9	50	60
									E15	15	2	37.7	65.1	72	70	80
	460	4.6	34	7.1	0.8	3.0	2.2	5.0	None	-	-	-	14.7	16.9	15	20
									E03	3	1	3.8	14.7	17.3	15	20
									E06	6	1	7.5	19	21.8	20	25
									E08	9	1	11.3	23.5	26.3	25	30
									E15	15	2	18.8	32.6	35.3	35	40
	575	3.5	28	5.5	0.6	2.4	1.8	4.0	None	-	-	-	11.5	13.3	15	15
									E08	9	1	9.0	18.8	21.1	20	25
									E15	15	2	15.1	26	28.3	30	30
049 (4)	208	11.9	88	18.5	1.5	6.0	5.5	10.0	None	-	-	-	33.9	39.4	45	50
									E06	4.5	1	12.5	35.6	42.5	45	50
									E08	6.8	1	18.9	43.6	50.5	45	60
									E15	11.3	2	31.4	59.2	66.1	60	70
									E20	15	2	41.6	72	78.9	80	80
	230	11.9	88	18.5	1.5	6.0	5.5	10.0	None	-	-	-	33.9	39.4	45	50
									E06	6	1	15.1	38	44.9	45	50
									E08	9	1	22.6	47.1	53.9	50	60
									E15	15	2	37.7	65.1	72	70	80
									E20	20	2	50.2	80.1	87	90	90
	460	5.2	44	8.1	0.8	3.0	2.2	5.0	None	-	-	-	16.1	18.3	20	20
									E06	6	1	7.5	19	21.8	20	25
									E08	9	1	11.3	23.5	26.3	25	30
									E15	15	2	18.8	32.6	35.3	35	40
									E20	20	2	25.1	40.1	42.8	45	45
	575	4.8	36	7.5	0.6	2.4	1.8	4.0	None	-	-	-	13.6	15.4	15	20
									E08	9	1	9.0	18.8	21.1	20	25
									E15	15	2	15.1	26	28.3	30	30
									E20	20	2	20.1	32.1	34.3	35	35
061 (5)	208	14.1	88	22	1.5	6.8	5.5	10.0	None	-	-	-	37.4	42.9	50	50
									E06	4.5	1	12.5	37.4	43.5	50	50
									E08	6.8	1	18.9	44.6	51.5	50	60
									E15	11.3	2	31.4	60.2	67.1	70	70
									E20	15	2	41.6	73	79.9	80	80
									E23	18	2	50.0	83.5	90.3	90	100
	230	14.1	88	22	1.5	6.8	5.5	10.0	None	-	-	-	37.4	42.9	50	50
									E06	6	1	15.1	39	45.9	50	50
									E08	9	1	22.6	48.1	54.9	50	60
									E15	15	2	37.7	66.1	73	70	80
									E20	20	2	50.2	81.1	88	90	90
									E23	24	2	60.2	93.2	100	100	100
	460	7.7	55	12	0.8	3.4	2.2	5.0	None	-	-	-	19.6	21.8	25	25
									E06	6	1	7.5	19.6	22.3	25	25
									E08	9	1	11.3	24	26.8	25	30
									E15	15	2	18.8	33.1	35.8	35	40
									E20	20	2	25.1	40.6	43.3	45	45
									E23	24	2	30.1	46.6	49.3	50	50
	575	5.1	36	7.5	0.6	2.7	1.8	4.0	None	-	-	-	14.3	16.1	15	20
									E08	9	1	9.0	19.2	21.5	20	25
									E15	15	2	15.1	26.4	28.7	30	30
									E20	20	2	20.1	32.4	34.7	35	35
									E23	24	2	24.1	37.2	39.5	40	40

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

Table 9: Physical Data

ZJ037-061 Single Stage Gas Heat Physical Data

Component	Models								
	ZJ037			ZJ049			ZJ061		
Nominal Tonnage	**3.0**			**4.0**			**5.0**		
ARI COOLING PERFORMANCE									
Gross Capacity @ ARI A point (MBh)	37000			50000			62000		
ARI net capacity (MBh)	36000			48000			60000		
EER	12.2			12.2			12.2		
SEER	15			15			15		
IPLV	-			-			-		
Nominal CFM	1300			1600			2000		
System power (KW)	2.95			3.95			4.90		
Refrigerant type	R-410A			R-410A			R-410A		
Refrigerant charge (lb-oz)									
System 1	6-12			8-8			8-4		
System 2	-			-			-		
ARI HEATING PERFORMANCE									
Heating model	A05	A07	A09	A05	A07	A09	A07	A09	A13
Heat input (K Btu)	60	80	120	60	80	120	80	120	160
Heat output (K Btu)	49	65	97	49	65	97	65	97	129
AFUE %	-		-	-		-	-		-
Steady state efficiency (%)	81.5	81	81	81.5	81	81	81	81	80.5
No. burners	4	4	6	4	4	6	4	6	8
No. stages	1	1	1	1	1	1	1	1	1
Temperature Rise Range (ºF)	20-50°F	25-65°F	50-80°F	20-50°F	25-65°F	40-70°F	25-65°F	35-65°F	45-75°F
Gas Limit Setting (ºF)	235°F	200°F	255°F	235°F	200°F	255°F	200°F	245°F	240°F
Gas piping connection (in.)	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
DIMENSIONS (inches)									
Length	89			89			89		
Width	59			59			59		
Height	42			42			42		
OPERATING WT. (lbs.)	740			762			770		
COMPRESSORS									
Type	Recip			Recip			Recip		
Quantity	1			1			1		
Unit Capacity Steps (%)	100			100			100		
CONDENSER COIL DATA									
Face area (Sq. Ft.)	18.5			18.5			23.8		
Rows	1			1			1		
Fins per inch	23			23			23		
Tube diameter (in./MM)	.71/18			.71/18			.71/18		
Circuitry Type	2-pass Microchannel			2-pass Microchannel			2-pass Microchannel		
EVAPORATOR COIL DATA									
Face area (Sq. Ft.)	7.9			10.5			10.5		
Rows	3			3			3		
Fins per inch	15			15			15		
Tube diameter	0.375			0.375			0.375		
Refrigerant control	TXV			TXV			TXV		

ZJ037-061 Single Stage Gas Heat Physical Data (Continued)

Component	Models								
	ZJ037			ZJ049			ZJ061		
Nominal Tonnage	**3.0**			**4.0**			**5.0**		
CONDENSER FAN DATA									
Quantity of fans	1			2			2		
Fan diameter (Inch)	24			24			24		
Type	Prop			Prop			Prop		
Drive type	Direct			Direct			Direct		
Quantity of motors	1			2			2		
Motor HP each	1/3			1/3			1/3		
No. speeds	1			1			1		
RPM	850			850			850		
Nominal total CFM	3300			5500			6300		
BELT DRIVE EVAP FAN DATA									
Quantity	1			1			1		
Fan Size (Inch)	12 x 9			12 x 9			12 x 9		
Type	Centrifugal			Centrifugal			Centrifugal		
Motor Sheave	1VM34		1VL44	1VM34		1VL44	1VL40		1VP56
Blower Sheave	AK69		AK69	AK56		AK56	AK61		AK74
Belt	A47		A47	A47		A47	A47		A51
Motor HP each	1-1/2		1-1/2	1-1/2		1-1/2	1-1/2		2
RPM	1725		1725	1725		1725	1725		1725
Frame size	56		56	56		56	56		56
FILTERS									
Quantity - Size	4 - (24 x 16 x 2)[1,2]			4 - (24 x 16 x 2)[1,2]			4 - (24 x 16 x 2)[1,2]		
	4 - (24 x 16 x 4)[3]			4 - (24 x 16 x 4)[3]			4 - (24 x 16 x 4)[3]		

1. 2 In. Throwaway, Standard, MERV (Minimum Efficiency Reporting Value) 3.
2. 2 In. Pleated, Optional, MERV 7.
3. 4 In. Pleated, Optional, MERV 13.

ZJ037-061 Two Stage Gas Heat Physical Data

Component	Models								
	ZJ037			ZJ049			ZJ061		
Nominal Tonnage	**3.0**			**4.0**			**5.0**		
ARI COOLING PERFORMANCE									
Gross Capacity @ ARI A point (MBh)	37000			50000			62000		
ARI net capacity (MBh)	36000			48000			60000		
EER	12.2			12.2			12.2		
SEER	15			15			15		
IPLV	-			-			-		
Nominal CFM	1300			1600			2000		
System power (KW)	2.95			3.95			4.90		
Refrigerant type	R-410A			R-410A			R-410A		
Refrigerant charge (lb-oz)									
System 1	6-12			8-8			8-4		
System 2	-			-			-		
ARI HEATING PERFORMANCE									
Heating model	N05	N07	N09	N05	N07	N09	N07	N09	N13
Heat input (K Btu)	60	80	120	60	80	120	80	120	160
Heat output (K Btu)	49	65	97	49	65	97	65	97	129
AFUE %	-		-	-		-	-		-
Steady state efficiency (%)	81.5	81	81	81.5	81	81	81	81	80.5
No. burners	4	4	6	4	4	6	4	6	8
No. stages	2^1	2^2	2^2	2^1	2^2	2^2	2^2	2^2	2^2
Temperature Rise Range (ºF)	20-50°F	25-65°F	50-80°F	20-50°F	25-65°F	40-70°F	25-65°F	35-65°F	45-75°F
Gas Limit Setting (ºF)	235°F	200°F	255°F	235°F	200°F	255°F	200°F	245°F	240°F
Gas piping connection (in.)	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
DIMENSIONS (inches)									
Length	89			89			89		
Width	59			59			59		
Height	42			42			42		
OPERATING WT. (lbs.)	740			762			770		
COMPRESSORS									
Type	Recip			Recip			Recip		
Quantity	1			1			1		
Unit Capacity Steps (%)	100			100			100		
CONDENSER COIL DATA									
Face area (Sq. Ft.)	18.5			18.5			23.8		
Rows	1			1			1		
Fins per inch	23			23			23		
Tube diameter (in./MM)	.71/18			.71/18			.71/18		
Circuitry Type	2-pass Microchannel			2-pass Microchannel			2-pass Microchannel		
EVAPORATOR COIL DATA									
Face area (Sq. Ft.)	7.9			10.5			10.5		
Rows	3			3			3		
Fins per inch	15			15			15		
Tube diameter	0.375			0.375			0.375		
Refrigerant control	TXV			TXV			TXV		

ZJ037-061 Two Stage Gas Heat Physical Data (Continued)

Component	Models								
	ZJ037			ZJ049			ZJ061		
Nominal Tonnage	**3.0**			**4.0**			**5.0**		
CONDENSER FAN DATA									
Quantity of fans	1			2			2		
Fan diameter (Inch)	24			24			24		
Type	Prop			Prop			Prop		
Drive type	Direct			Direct			Direct		
Quantity of motors	1			2			2		
Motor HP each	1/3			1/3			1/3		
No. speeds	1			1			1		
RPM	850			850			850		
Nominal total CFM	3300			5500			6300		
BELT DRIVE EVAP FAN DATA									
Quantity	1			1			1		
Fan Size (Inch)	12 x 9			12 x 9			12 x 9		
Type	Centrifugal			Centrifugal			Centrifugal		
Motor Sheave	1VM34		1VL44	1VM34		1VL44	1VL40		1VP56
Blower Sheave	AK69		AK69	AK56		AK56	AK61		AK74
Belt	A47		A47	A47		A47	A47		A51
Motor HP each	1-1/2		1-1/2	1-1/2		1-1/2	1-1/2		2
RPM	1725		1725	1725		1725	1725		1725
Frame size	56		56	56		56	56		56
FILTERS									
Quantity - Size	4 - (24 x 16 x 2)[3,4] 4 - (24 x 16 x 4)[5]			4 - (24 x 16 x 2)[3,4] 4 - (24 x 16 x 4)[5]			4 - (24 x 16 x 2)[3,4] 4 - (24 x 16 x 4)[5]		

1. 1st Stage Capacity is 75% of Full Capacity.
2. 1st Stage Capacity is 70% of Full Capacity.
3. 2 In. Throwaway, Standard, MERV (Minimum Efficiency Reporting Value) 3.
4. 2 In. Pleated, Optional, MERV 7.
5. 4 In. Pleated, Optional, MERV 13.

Optional Electric Heat

The factory-installed heaters are wired for single point power supply. Power supply need only be brought into the single point terminal block.

These CSA approved heaters are located within the central compartment of the unit with the heater elements extending in to the supply air chamber.

Fuses are supplied, where required, by the factory. Some kW sizes require fuses and others do not. refer to Table 10 for minimum CFM limitations and to Table 8 for electrical data.

Table 10: Electric Heat Minimum Supply Air

Size (Tons)	Model	Voltage	Minimum Supply Air (CFM)					
			Heater kW					
			3	6	9	15	20	24
037 (3)	ZJ	208/230-3-60	960	960	1020	1000	-	-
		460-3-60	980	960	960	960	-	-
		600-3-60	-	-	960	960	-	-
049 (4)	ZJ	208/230-3-60	-	1280	1420	1400	1400	-
		460-3-60	-	1400	1400	1400	1400	-
		600-3-60	-	-	1400	1400	1400	-
061 (5)	ZJ	208/230-3-60	-	1600	1600	1600	1600	1600
		460-3-60	-	1600	1600	1600	1600	1600
		600-3-60	-	-	1600	1600	1600	1600

Optional Gas Heat

These gas-fired heaters have aluminized-steel or optional stainless steel, tubular heat exchangers with spark ignition.

Gas Piping

Proper sizing of gas piping depends on the cubic feet per hour of gas flow required, specific gravity of the gas and the length of run. "National Fuel Gas Code" Z223.1 (in U.S.A.) or the current Gas Installation Codes CSA-B149.1 (in Canada) should be followed in all cases unless superseded by local codes or gas utility requirements. Refer to the Pipe Sizing Table 11. The heating value of the gas may differ with locality. The value should be checked with the local gas utility.

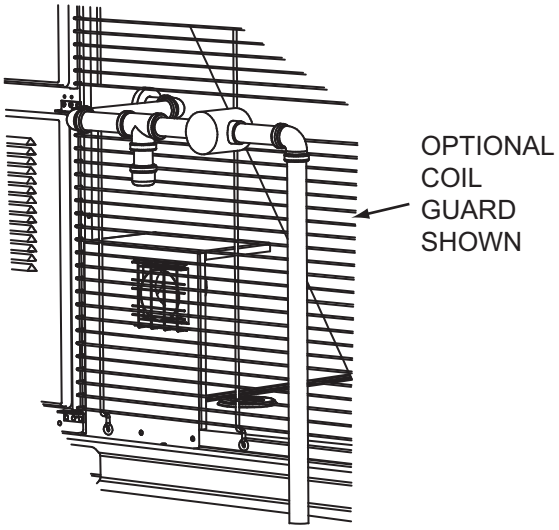


Figure 22: Side Entry Gas Piping

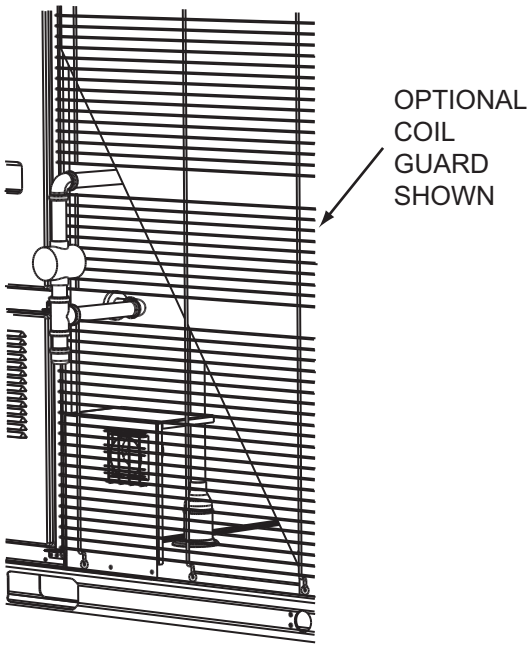


Figure 23: Bottom Entry Gas Piping

Table 11: Gas Pipe Sizing - Capaclty of Pipe

Length of Pipe (ft.)	Nominal Iron Pipe Size		
	3/4 in.	1 in.	1-1/4 in.
10	278	520	1050
20	190	350	730
30	152	285	590
40	130	245	500
50	115	215	440
60	105	195	400
70	96	180	370
80	90	170	350
90	84	160	320
100	79	150	305

NOTE: Maximum capacity of pipe in cubic feet of gas per hour based upon a pressure drop of 0.3 inch W.C. and 0.6 specific gravity gas.

NOTE: There may be a local gas utility requirement specifying a minimum diameter for gas piping. All units require a 3/4 inch pipe connection at the entrance fitting. Line should not be sized smaller than the entrance fitting size.

Table 12: Gas Heat Minimum Supply Air

Size (Tons)	Model	Heat Size	Supply Air (CFM) Heating	
			Min	Max
037 (3)	ZJ	A05 / N05	890	2220
		A07 / N07	915	2370
		A09 / N09	1130	1800
049 (4)	ZJ	A05 / N05	890	2220
		A07 / N07	915	2370
		A09 / N09	1290	2250
061 (5)	ZJ	A07 / N07	915	2370
		A09 / N09	1380	2570
		A13 / N13	1580	2630

Gas Connection

The gas supply line can be routed within the space and roof curb, exiting through the unit's basepan. Refer to Figures 8 and 11 for the gas piping inlet location. Typical supply piping arrangements are shown in Figures 22 and 23. All pipe nipples, fittings, and the gas cock are field supplied or may be purchased in UP accessory kit #1GP0405.

Gas piping recommendations:

1. A drip leg and a ground joint union must be installed in the gas piping.
2. Where required by local codes, a manual shut-off valve must be installed outside of the unit.
3. Use wrought iron or steel pipe for all gas lines. Pipe dope should be applied sparingly to male threads only.

⚠WARNING

Natural gas may contain some propane. Propane is an excellent solvent and will quickly dissolve white lead and most standard commercial compounds. A special pipe dope must be used when assembling wrought iron or steel pipe. Shellac based compounds such as Gaskolac or Stalastic, and compounds such as Rectorseal #5, Clydes's or John Crane may be used.

4. All piping should be cleaned of dirt and scale by hammering on the outside of the pipe and blowing out loose particles. Before initial start-up, be sure that all gas lines external to the unit have been purged of air.
5. The gas supply should be a separate line and installed in accordance with all safety codes as prescribed under "Limitations".
6. A 1/8-inch NPT plugged tapping, accessible for test gage connection, must be installed immediately upstream of the gas supply connection to the unit.
7. After the gas connections have been completed, open the main shut-off valve admitting *normal gas pressure* to the mains. *Check all joints for leaks with soap solution or other material suitable for the purpose.* **NEVER USE A FLAME.**

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

⚠ CAUTION

The furnace and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing at pressures in excess of 1/2 PSIG.

Pressures greater than 1/2 PSIG will cause gas valve damage resulting in a hazardous condition. If it is subjected to a pressure greater than 1/2 PSIG, the gas valve must be replaced.

The furnace must be isolated from the gas supply piping system by closing its individual manual shut-off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG.

⚠WARNING

Threaded joints should be coated with a sealing compound that is resistant to the action of liquefied petroleum gases. **Do not use Teflon tape.**

LP Units, Tanks And Piping

All gas heat units are shipped from the factory equipped for natural gas use only. The unit may be converted in the field for use with LP gas with accessory kit model numbers 1NP0454 or 1NP0455.

All LP gas equipment must conform to the safety standards of the National Fire Protection Association.

For satisfactory operation, LP gas pressure must be 10.5 inch W.C. at the unit under full load. Maintaining proper gas pressure depends on three main factors:

1. The vaporization rate which depends on the temperature of the liquid and the “wetted surface” area of the container(s).
2. The proper pressure regulation. (Two-stage regulation is recommended).
3. The pressure drop in the lines between regulators and between the second stage regulator and the appliance. Pipe size required will depend on the length of the pipe run and the total load of all appliances.

Complete information regarding tank sizing for vaporization, recommended regulator settings, and pipe sizing is available from most regulator manufacturers and LP gas suppliers.

⚠WARNING

LP gas is an excellent solvent and will quickly dissolve white lead and most standard commercial compounds. A special pipe dope must be used when assembling wrought iron or steel pipe for LP. Shellac base compounds such as Gaskolac or Stalastic, and compounds such as Rectorseal #5, Clyde’s, or John Crane may be used.

Check all connections for leaks when piping is completed using a soap solution. **NEVER USE A FLAME.**

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

Vent And Combustion Air

Venting slots in the heating compartment access panel remove the need for a combustion air hood. The gas heat flue exhaust is routed through factory installed exhaust piping with screen. If necessary, a flue exhaust extension may be installed at the point of installation.

Options/Accessories

Electric Heat

Electric heaters are available as factory-installed options or field-installed accessories. Refer to electric heat instructions for installation. These heaters mount in the heat compartment with the heating elements extending into the supply air chamber. All electric heaters are fused and intended for use with single point power supply.

Smoke Detectors

⚠WARNING

The use of duct smoke detectors have specific limitations as established by the National Fire Protection Association. Duct smoke detectors are; NOT a substitute for an open area smoke detector, NOT a substitute for early warning detection, and NOT a replacement for a building's regular fire detection system. Refer to NFPA Code 72 and Standard 90A for additional information.

The factory-installed smoke detector will shut down operation of the unit by interrupting power to the UCB when smoke is detected within its mounting compartment. The smoke detector option is available for both supply and/or return air configurations. Be aware that the supply air configuration has the sensor component mounted in the blower section, with its control module mounted in the return air compartment.

⚠WARNING

Factory-installed smoke detectors may be subjected to extreme temperatures during "off" times due to outside air infiltration. These smoke detectors have an operational limit of -4°F to 158°F. Smoke detectors installed in areas that could be outside this range will have to be relocated to prevent false alarms.

⚠WARNING

To assure adequate airflow reaches the smoke detector's sensor, make sure that the holes of the sampling tube face into the air stream, and that the far-end of the sampling tube is sealed with the plastic end cap.

In addition, the unit's supply airflow must be adjusted to provide a pressure differential across the smoke detector's sampling and exhaust ports of at least 0.01 inches of water and no more than 1.11 inches of water, as measured by a manometer.

The detector must be tested and maintained on a regular basis according to NFPA 72 requirements and cleaned at least once a year. For specific troubleshooting and maintenance procedures, please refer to the smoke detector's installation instructions which accompanies the unit.

Motorized Outdoor Damper

The Motorized Outdoor Damper can be a factory installed option or a field installed accessory. If factory installed, refer to the instructions included with the outdoor air hood to complete the assembly. Field installed Motorized Outdoor Damper accessories include complete instructions for installation.

Economizer

The Economizer can be a factory installed option or a field installed accessory. If factory installed, refer to the instructions included with the outdoor air hood to complete the assembly. Field installed Economizer accessories include complete instructions for installation.

There are two Economizer options:

1. Down Flow application with barometric relief hood standard.
2. Horizontal Flow application that requires the purchase of a barometric relief hood.

Power Exhaust

The Power Exhaust can be a factory installed option or a field installed accessory. If factory installed, refer to the instructions included with the outdoor air hood to complete the assembly. Field installed Power Exhaust accessories include complete instructions for installation.

The Power Exhaust factory installed option is for Down Flow application only.

There are two field installed Power Exhaust accessories:

1. Down Flow application.
2. Horizontal Flow application that requires the purchase of a barometric relief hood.

Rain Hood

All of the hood components, including the filters, the gasketing and the hardware for assembling, are packaged and located between the condenser coil section and the main unit cabinet, if the unit has factory installed options. If field installed accessories are being installed all parts necessary for the installation comes in the accessory.

Standard Economizer and Power Exhaust Set Point Adjustments

(Not applicable to INTELLI-Comfort™ or BAS Units)

Remove the top rear access panel from the unit. Locate the economizer control module, where the following adjustments will be made.

⚠ CAUTION

Extreme care must be exercised in turning all set point, maximum and minimum damper positioning adjustment screws to prevent twisting them off.

Minimum Position Adjustment

- Check that the damper blades move smoothly without binding; carefully turn the Minimum Position Adjust screw (found on the damper control module) fully clockwise and then set the thermostat indoor fan switch to the ON position and then OFF or energize and de-energize terminals “R” to “G”.
- With the thermostat set to the indoor fan ON position or terminals “R” to “G” energized, turn the Minimum Position Adjusting screw (located on the damper control module) counterclockwise until the desired minimum damper position has been attained.

Enthalpy Set Point Adjustment

- The enthalpy set point may now be set by selecting the desired set point shown in the Enthalpy Set Point Adjustment Figure 24. Adjust as follows:
- For a single enthalpy operation carefully turn the set point adjusting screw (found on the damper control module) to the "A", "B", "C" or "D" setting corresponding to the lettered curve of the Enthalpy Set Point Adjustment Figure 25.
- For a dual enthalpy operation, carefully turn the set point adjusting screw fully clockwise past the "D" setting.

Power Exhaust Damper Set Point (With Or Without Power Exhaust)

- With no power exhaust option, adjust the Exhaust Air Adjustment Screw fully clockwise. This will allow 2nd stage cooling to operate.
- With power exhaust option, each building pressurization requirement will be different. The point at which the power exhaust comes on is determined by the economizer damper position (Percent Open). The Exhaust Air Adjustment Screw should be set at the Percent Open of the economizer damper at which the power exhaust is needed. It can be set from 0 to 100% damper open.

Indoor Air Quality AQ

Indoor Air Quality (indoor sensor input): Terminal AQ accepts a +2 to +10 Vdc signal with respect to the (AQ1) terminal. When the signal is below it's set point, the actuator is allowed to modulate normally in accordance with the enthalpy and mixed air sensor inputs. When the AQ signal exceeds it's set point setting and there is no call for free cooling, the actuator is proportionately modulated from the 2 to 10 Vdc signal, with 2 Vdc corresponding to full closed and 10 Vdc corresponding to full open. When there is no call for free cooling, the damper position is limited by the IAQ Max damper position setting. When the signal exceeds it's set point (Demand Control Ventilation Set Point) setting and there is a call for free cooling, the actuator modulates from the minimum position to the full open position based on the highest call from either the mixed air sensor input or the AQ voltage input.

- Optional CO_2 Space Sensor Kit Part # 2AQ04700324
- Optional CO_2 Sensor Kit Part # 2AQ04700424

Replace the top rear access panel on the unit.

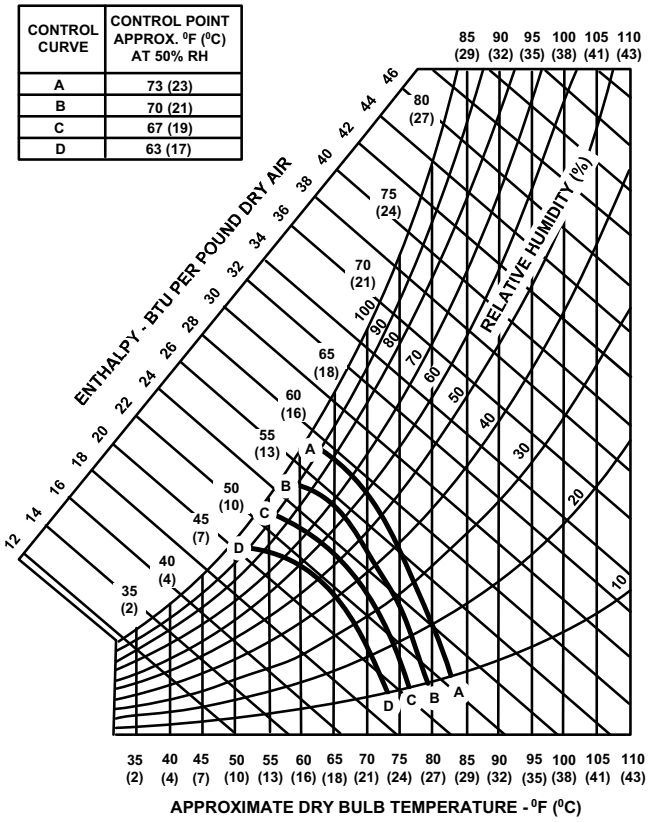

CONTROL CURVE
CONTROL POINT APPROX. °F (°C) AT 50% RH
A 73 (23)
B 70 (21)
C 67 (19)
D 63 (17)
ENTHALPY - BTU PER POUND DRY AIR
RELATIVE HUMIDITY (%)
APPROXIMATE DRY BULB TEMPERATURE - °F (°C)

Figure 24: Enthalpy Set Point Chart

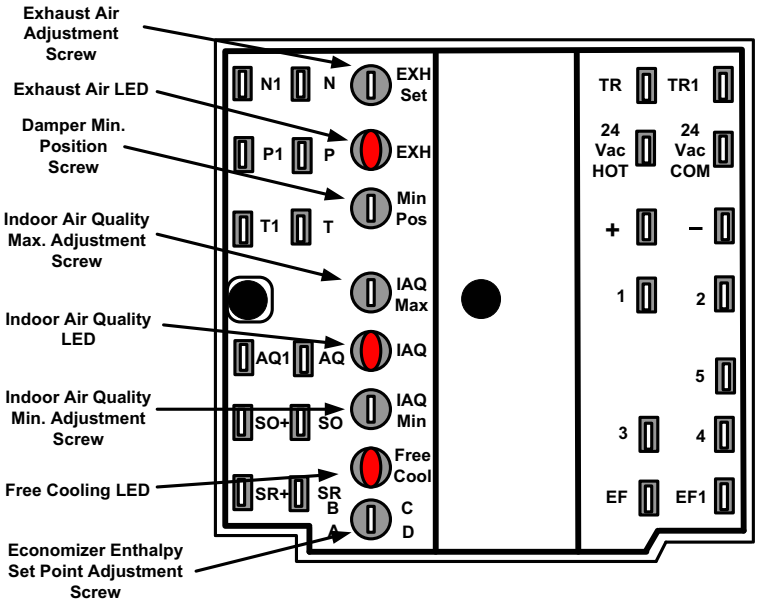


Figure 25: Honeywell Economizer Control W7212

Phasing

Predator® units are properly phased at the factory. Check for proper compressor rotation. If the blower or compressors rotate in the wrong direction at start-up, the electrical connection to the unit is misphased. Change the phasing of the **Field Line Connection at the factory or field supplied disconnect** to obtain proper rotation. (Scroll compressors operate in only one

direction. If the scroll is drawing low amperage, has similar suction and discharge pressures, or producing a high noise level, the scroll is misphased.)

⚠ CAUTION

Scroll compressors require proper rotation to operate correctly. Units are properly phased at the factory. Do not change the internal wiring to make the blower condenser fans, or compressor rotate correctly.

Blower Rotation

Check for proper supply air blower rotation. If the blower is rotating backwards, the line voltage at the unit point of power connection is misphased (See 'PHASING').

Table 13: Supply Air Limitations

Unit Size (Ton)	Minimum	Maximum
037 (3.0)	900	1500
049 (4.0)	1200	2000
061 (5.0)	1500	2500

Belt Tension

The tension on the belt should be adjusted as shown in Figure 26.

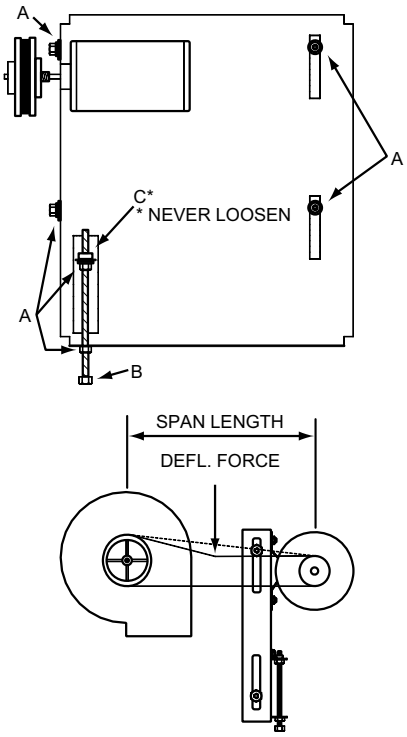


Figure 26: Belt Adjustment

⚠ CAUTION

Procedure for adjusting belt tension:

1. Loosen six nuts (top and bottom) A.
2. Adjust by turning (B).
3. Never loosen nuts (C).
4. Use belt tension checker to apply a perpendicular force to one belt at the midpoint of the span as shown. Deflection distance of 4mm (5/32") is obtained.

To determine the deflection distance from normal position, use a straight edge from sheave to sheave as reference line. The recommended deflection force is as follows:

Tension new belts at the max. deflection force recommended for the belt section. Check the belt tension at least two times during the first 24 hours of operation. Any retensioning should fall between the min. and max. deflection force values.

5. After adjusting retighten nuts (A).

CFM Static Pressure and Power-Altitude and Temperature Corrections

The information below should be used to assist in application of product when being applied at altitudes at or exceeding 1000 feet above sea level.

The air flow rates listed in the standard blower performance tables are based on standard air at sea level. As the altitude or temperature increases, the density of air decreases. In order to use the indoor blower tables for high altitude applications, certain corrections are necessary.

A centrifugal fan is a "constant volume" device. This means that, if the rpm remains constant, the CFM delivered is the same regardless of the density of the air. However, since the air at high altitude is less dense, less static pressure will be generated and less power will be required than a similar application at sea level. Air density correction factors are shown in Table 14 and Figure 27.

Table 14: Altitude/Temperature Correction Factors

Air Temp.	Altitude (Ft.)										
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
40	1.060	1.022	0.986	0.950	0.916	0.882	0.849	0.818	0.788	0.758	0.729
50	1.039	1.002	0.966	0.931	0.898	0.864	0.832	0.802	0.772	0.743	0.715
60	1.019	0.982	0.948	0.913	0.880	0.848	0.816	0.787	0.757	0.729	0.701
70	1.000	0.964	0.930	0.896	0.864	0.832	0.801	0.772	0.743	0.715	0.688
80	0.982	0.947	0.913	0.880	0.848	0.817	0.787	0.758	0.730	0.702	0.676
90	0.964	0.929	0.897	0.864	0.833	0.802	0.772	0.744	0.716	0.689	0.663
100	0.946	0.912	0.880	0.848	0.817	0.787	0.758	0.730	0.703	0.676	0.651

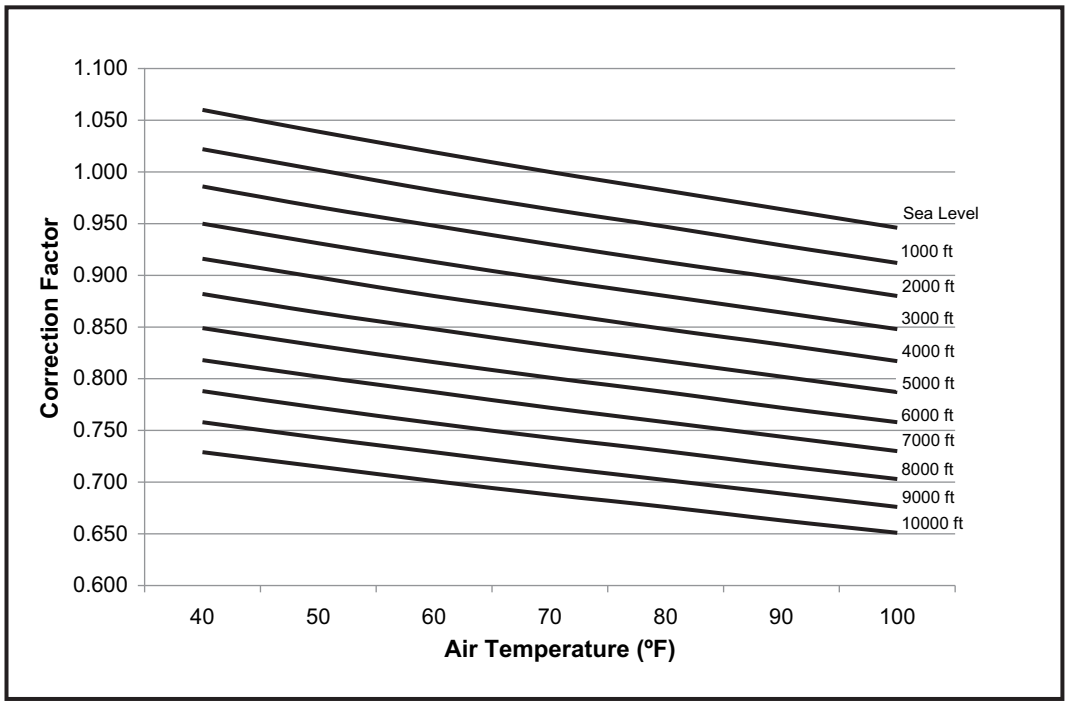


Figure 27: Altitude/Temperature Correction Factors

The examples below will assist in determining the airflow performance of the product at altitude.

Example 1: What are the corrected CFM, static pressure, and BHP at an elevation of 5,000 ft. if the blower performance data is 6,000 CFM, 1.5 IWC and 4.0 BHP?

Solution: At an elevation of 5,000 ft. the indoor blower will still deliver 6,000 CFM if the rpm is unchanged. However, Table 13 must be used to determine the static pressure and BHP. Since no temperature data is given, we will assume an air temperature of 70°F. Table 15 shows the correction factor to be 0.832.

Corrected static pressure = 1.5 x 0.832 = 1.248 IWC

Corrected BHP = 4.0 x 0.832 = 3.328

Example 2: A system, located at 5,000 feet of elevation, is to deliver 6,000 CFM at a static pressure of 1.5". Use the unit blower tables to select the blower speed and the BHP requirement.

Solution: As in the example above, no temperature information is given so 70°F is assumed.

The 1.5" static pressure given is at an elevation of 5,000 ft. The first step is to convert this static pressure to equivalent sea level conditions.

Sea level static pressure = 1.5 / .832 = 1.80"

Enter the blower table at 6000 sCFM and static pressure of 1.8". The rpm listed will be the same rpm needed at 5,000 ft.

Suppose that the corresponding BHP listed in the table is 3.2. This value must be corrected for elevation.

BHP at 5,000 ft. = 3.2 x .832 = 2.66

Drive Selection

1. Determine side or bottom supply duct Application.
2. Determine desired airflow.
3. Calculate or measure the amount of external static pressure.
4. Using the operating point determined from steps 1, 2 & 3, locate this point on the appropriate supply air blower performance table. (Linear interpolation may be necessary.)
5. Noting the RPM and BHP from step 4, locate the appropriate motor and, or drive.
6. Review the BHP compared to the motor options available. Select the appropriate motor and, or drive.
7. Review the RPM range for the motor options available. Select the appropriate drive if multiple drives are available for the chosen motor.
8. Determine turns open to obtain the desired operation point.

Example

1. 2400 CFM
2. 1.6 IWC
3. Using the supply air blower performance table below, the following data point was located: 1230 RPM & 1.62 BHP.
4. Using the RPM selection table below, Size X and Model Y is found.
5. 1.62 BHP exceeds the maximum continuous BHP rating of the 1.5 HP motor. The 2 HP motor is required.
6. 1230 RPM is within the range of the 2 HP drives.
7. Using the 2 HP motor and drive, .5 turns open will achieve 1230 RPM.

Airflow Performance

Example Supply Air Blower Performance

Air Flow (CFM)	Available External Static Pressure - IWG																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	1.5 HP & Field Supplied Drive						Standard 1.5 HP & Drive								Hi Static 2 HP & Drive					
2100	759	0.65	819	0.77	881	0.87	943	0.98	1005	1.08	1065	1.18	1121	1.28	1172	1.38	1217	1.48	1254	1.59
2200	778	0.73	838	0.84	900	1.95	962	1.05	1024	1.15	1083	1.25	1139	1.35	1191	1.45	1236	1.56	1273	1.66
2300	797	0.81	857	0.92	919	1.03	981	1.13	1043	1.23	1103	1.33	1159	1.43	1210	1.53	1255	1.64	1292	1.74
2400	817	1.90	877	1.01	939	1.12	1002	1.22	1063	1.32	1123	1.42	1179	1.52	1230	1.62	1275	1.73	1312	1.83

Table X: RPM Selection

Size (Tons)	Model	HP	Max BHP	Motor Sheave	Blower Sheave	6 Turns Open	5 Turns Open	4 Turns Open	3 Turns Open	2 Turns Open	1 Turn Open	Fully Closed
X	Y	1.5	1.73	1VL40	AK61	N/A	787	847	908	968	1029	1089
		2	2.30	1VP56	AK74	N/A	1035	1084	1134	1183	1232	1281

Table 15: Airflow Performance - Side Duct Application

ZJ037 (3.0 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 1.5 HP & Drive								Hi Static 1.5 HP & Drive											
900	560	0.29	628	0.35	695	0.42	760	0.51	823	0.61	886	0.72	949	0.82	1011	0.92	1073	1.01	1136	1.09
1000	582	0.29	650	0.34	716	0.42	781	0.51	845	0.61	908	0.71	970	0.82	1032	0.92	1095	1.01	1158	1.08
1100	601	0.30	670	0.35	736	0.43	801	0.52	864	0.62	927	0.72	990	0.83	1052	0.93	1114	1.02	1177	1.09
1200	620	0.32	688	0.37	754	0.45	819	0.54	883	0.64	946	0.74	1008	0.85	1070	0.95	1133	1.04	1196	1.11
1300	638	0.35	706	0.40	772	0.48	837	0.57	901	0.67	964	0.77	1026	0.88	1088	0.98	1151	1.06	1214	1.14
1400	655	0.39	724	0.44	790	0.51	855	0.60	918	0.70	981	0.81	1044	0.91	1106	1.01	1168	1.10	1231	1.18
1500	673	0.43	741	0.48	807	0.56	872	0.65	936	0.75	999	0.85	1061	0.96	1124	1.06	1186	1.15	1249	1.22
															1.5 HP & Field Supplied Drive					

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.

ZJ049 (4.0 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	FS[4]		Standard 1.5 HP & Drive										Hi Static 1.5 HP & Drive							
1200	608	0.25	677	0.34	744	0.44	807	0.54	868	0.64	927	0.74	986	0.84	1043	0.93	1101	1.02	1160	1.10
1300	623	0.28	692	0.37	758	0.47	822	0.57	883	0.67	942	0.77	1001	0.86	1058	0.96	1116	1.04	1175	1.13
1400	637	0.31	706	0.40	772	0.50	836	0.60	897	0.70	956	0.80	1015	0.90	1072	0.99	1130	1.08	1189	1.16
1500	650	0.35	720	0.44	786	0.54	849	0.64	911	0.74	970	0.84	1028	0.93	1086	1.03	1144	1.12	1202	1.20
1600	664	0.39	734	0.49	800	0.58	863	0.68	924	0.78	984	0.88	1042	0.98	1100	1.07	1158	1.16	1216	1.24
1700	678	0.44	748	0.54	814	0.63	877	0.73	938	0.83	998	0.93	1056	1.03	1114	1.12	1172	1.21	1230	1.29
1800	693	0.50	763	0.59	829	0.69	892	0.79	953	0.89	1013	0.99	1071	1.08	1129	1.18	1186	1.26	1245	1.35
1900	708	0.56	778	0.65	844	0.75	907	0.85	968	0.95	1028	1.05	1086	1.15	1144	1.24	1202	1.33	1260	1.41
2000	725	0.62	794	0.72	860	0.82	924	0.92	985	1.02	1044	1.12	1102	1.21	1160	1.30	1218	1.39	1277	1.47

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive

ZJ061 (5.0 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	1.5 HP & Field Suplied Drive						Standard 1.5 HP & Drive								Hi Static 2 HP & Drive					
1500	659	0.35	719	0.46	780	0.57	843	0.67	905	0.77	964	0.87	1020	0.97	1071	1.07	1116	1.17	1154	1.28
1600	675	0.38	735	0.50	796	0.60	859	0.71	920	0.81	980	0.91	1036	1.01	1087	1.11	1132	1.21	1170	1.32
1700	691	0.42	751	0.54	812	0.64	875	0.75	936	0.85	996	0.95	1052	1.05	1103	1.15	1148	1.25	1186	1.36
1800	707	0.47	767	0.58	829	0.69	891	0.79	953	0.90	1012	0.99	1069	1.09	1120	1.20	1165	1.30	1202	1.41
1900	724	0.53	784	0.64	846	0.75	908	0.85	970	0.95	1029	1.05	1085	1.15	1137	1.25	1182	1.35	1219	1.46
2000	741	0.59	801	0.70	863	0.81	925	0.91	987	1.01	1047	1.11	1103	1.21	1154	1.31	1199	1.41	1236	1.52
2100	759	0.65	819	0.77	881	0.87	943	0.98	1005	1.08	1065	1.18	1121	1.28	1172	1.38	1217	1.48	1254	1.59
2200	778	0.73	838	0.84	900	0.95	962	1.05	1024	1.15	1083	1.25	1139	1.35	1191	1.45	1236	1.56	1273	1.66
2300	797	0.81	857	0.92	919	1.03	981	1.13	1043	1.23	1103	1.33	1159	1.43	1210	1.53	1255	1.64	1292	1.74
2400	817	0.90	877	1.01	939	1.12	1002	1.22	1063	1.32	1123	1.42	1179	1.52	1230	1.62	1275	1.73	1312	1.83
2500	838	1.00	898	1.11	960	1.22	1022	1.32	1084	1.42	1144	1.52	1200	1.62	1251	1.72	1296	1.82	1333	1.93
																	FS[4]			

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Suppied Drive.

Table 16: Airflow Performance - Bottom Duct Application

ZJ037 (3.0 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 1.5 HP & Drive						Hi Static 1.5 HP & Drive													
900	605	0.23	671	0.33	738	0.42	804	0.52	869	0.62	933	0.71	995	0.80	1054	0.89	1111	0.98	1164	1.07
1000	621	0.25	688	0.34	754	0.44	820	0.53	885	0.63	949	0.72	1011	0.82	1071	0.91	1127	1.00	1180	1.09
1100	637	0.27	703	0.36	769	0.46	835	0.56	900	0.65	964	0.74	1026	0.84	1086	0.93	1142	1.02	1195	1.11
1200	651	0.30	717	0.39	784	0.49	850	0.58	915	0.68	979	0.77	1041	0.87	1100	0.96	1157	1.05	1210	1.13
1300	666	0.33	732	0.43	799	0.52	865	0.62	930	0.71	994	0.81	1056	0.90	1115	0.99	1172	1.08	1225	1.17
1400	681	0.37	747	0.47	814	0.56	880	0.66	945	0.75	1009	0.85	1071	0.94	1130	1.03	1187	1.12	1240	1.21
1500	697	0.42	763	0.51	830	0.61	896	0.71	961	0.80	1025	0.90	1087	0.99	1146	1.08	1203	1.17	1256	1.26
															1.5 HP & Field Supplied Drive					

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.

ZJ049 (4.0 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	FS[4]		Standard 1.5 HP & Drive										Hi Static 1.5 HP & Drive							
1200	651	0.30	717	0.39	784	0.49	850	0.58	915	0.68	979	0.77	1041	0.87	1100	0.96	1157	1.05	1210	1.13
1300	666	0.33	732	0.43	799	0.52	865	0.62	930	0.71	994	0.81	1056	0.90	1115	0.99	1172	1.08	1225	1.17
1400	681	0.37	747	0.47	814	0.56	880	0.66	945	0.75	1009	0.85	1071	0.94	1130	1.03	1187	1.12	1240	1.21
1500	697	0.42	763	0.51	830	0.61	896	0.71	961	0.80	1025	0.90	1087	0.99	1146	1.08	1203	1.17	1256	1.26
1600	714	0.47	780	0.57	846	0.66	913	0.76	978	0.86	1042	0.95	1103	1.04	1163	1.14	1220	1.22	1273	1.31
1700	732	0.53	798	0.63	864	0.73	930	0.82	996	0.92	1059	1.01	1121	1.10	1181	1.20	1237	1.29	1291	1.37
1800	751	0.60	817	0.70	883	0.79	950	0.89	1015	0.98	1079	1.08	1140	1.17	1200	1.26	1257	1.35	1310	1.44
1900	771	0.68	837	0.77	904	0.87	970	0.96	1035	1.06	1099	1.15	1161	1.25	1220	1.34	1277	1.43	-	-
2000	793	0.75	859	0.85	925	0.95	991	1.04	1056	1.14	1120	1.23	1182	1.32	1242	1.42	1298	1.51	-	-

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.

ZJ061 (5.0 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	1.5 HP & Field Supplied Drive				Standard 1.5 HP & Drive										Hi Static 2 HP & Drive					
1500	673	0.47	736	0.54	797	0.63	855	0.72	910	0.82	964	0.92	1016	1.03	1067	1.14	1117	1.25	1166	1.36
1600	693	0.49	756	0.57	817	0.65	874	0.75	930	0.85	984	0.95	1036	1.06	1087	1.17	1137	1.28	1186	1.39
1700	713	0.53	777	0.60	837	0.69	895	0.78	951	0.88	1004	0.98	1057	1.09	1107	1.20	1157	1.31	1207	1.42
1800	734	0.57	797	0.65	858	0.73	916	0.83	971	0.92	1025	1.03	1077	1.14	1128	1.25	1178	1.36	1228	1.47
1900	755	0.62	819	0.70	879	0.79	937	0.88	992	0.98	1046	1.08	1098	1.19	1149	1.30	1199	1.41	1249	1.52
2000	776	0.69	840	0.76	900	0.85	958	0.94	1014	1.04	1067	1.14	1120	1.25	1171	1.36	1221	1.47	1270	1.59
2100	798	0.76	861	0.84	921	0.92	979	1.02	1035	1.11	1089	1.22	1141	1.32	1192	1.44	1242	1.55	1291	1.66
2200	819	0.84	882	0.92	943	1.00	1001	1.10	1056	1.20	1110	1.30	1162	1.41	1213	1.52	1263	1.63	1312	1.74
2300	840	0.93	903	1.01	964	1.10	1022	1.19	1077	1.29	1131	1.39	1183	1.50	1234	1.61	1284	1.72	1334	1.83
2400	861	1.03	925	1.11	985	1.20	1043	1.29	1099	1.39	1152	1.49	1204	1.60	1255	1.71	1305	1.82	1355	1.93
2500	882	1.14	946	1.22	1006	1.30	1064	1.40	1120	1.50	1173	1.60	1226	1.71	1276	1.82	1326	1.93	1376	2.04
															3 HP & Field Supplied Drive					

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.

Table 17: RPM Selection

Size (Tons)	Model	HP	Max BHP	Motor Sheave	Blower Sheave	6 Turns Open	5 Turns Open	4 Turns Open	3 Turns Open	2 Turns Open	1 Turn Open	Fully Closed
037	ZJ	1.5	1.5	1VP34	AK69	N/A	531	584	637	690	743	796
(3)		1.5	1.5	1VL44	AK69	N/A	796	849	902	955	1008	1062
049	ZJ	1.5	1.5	1VP34	AK56	N/A	663	730	796	863	929	995
(4)		1.5	1.5	1VL44	AK56	N/A	995	1062	1128	1194	1261	1327
061	ZJ	1.5	1.5	1VL40	AK61	N/A	787	847	908	968	1029	1089
(5)		2	2	1VP56	BK74	N/A	1035	1084	1134	1183	1232	1281

Table 18: Indoor Blower Specifications

Size (Tons)	Model	Motor					Motor Sheave			Blower Sheave			Belt
		HP	RPM	Eff.	SF	Frame	Datum Dia. (in.)	Bore (in.)	Model	Datum Dia. (in.)	Bore (in.)	Model	
037	ZJ	1-1/2	1725	0.8	1.15	56	2.0 - 3.0	7/8	1VM34	6.5	1	AK69	A47
(3)		1-1/2	1725	0.8	1.15	56	3.0 - 4.0	7/8	1VL44	6.5	1	AK69	A47
049	ZJ	1-1/2	1725	0.8	1.15	56	2.0 - 3.0	7/8	1VM34	5.2	1	AK56	A47
(4)		1-1/2	1725	0.8	1.15	56	3.0 - 4.0	7/8	1VL44	5.2	1	AK56	A47
061	ZJ	1-1/2	1725	0.8	1.15	56	2.6 - 3.6	7/8	1VL40	5.7	1	AK61	A47
(5)		2	1725	0.8	1.15	56	4.2 - 5.2	7/8	1VP56	7.0	1	BK74	A51

Table 19: Power Exhaust Specifications

Model	Voltage	Motor			Motor			Fuse Size	CFM @ 0.1 ESP
		HP	RPM[1]	QTY	LRA	FLA	MCA		
2PE04703225	208/230-1-60	3/4	1075	1	7.8	5	6.3	10	3800
2PE04703246	460-1-60	3/4	1075	1	3.4	2.2	2.8	5	3800
2PE04703258	575-1-60	3/4	1050	1	2.9	1.5	1.9	4	3800

1. Motors are multi-tapped and factory wired for high speed.

Air Balance

Start the supply air blower motor. Adjust the resistances in both the supply and the return air duct systems to balance the air distribution throughout the conditioned space. The job specifications may require that this balancing be done by someone other than the equipment installer.

⚠ CAUTION

Belt drive blower systems MUST be adjusted to the specific static and CFM requirements for the application. The Belt drive blowers are NOT set at the factory for any specific static or CFM. Adjustments of the blower speed and belt tension are REQUIRED. Verify proper sheave alignment; tighten blower pulley and motor sheave set screws after these adjustments. Re-checking set screws after 10-12 hrs. run time is recommended.

Checking Air Quantity

Method One

1. Remove the dot plugs from the duct panel (for location of the dot plugs see Figures 12 and 13).
2. Insert eight-inches of 1/4 inch metal tubing into the airflow on both sides of the indoor coil.

NOTE: The tubes must be inserted and held in a position perpendicular to the air flow so that velocity pressure will not affect the static pressure readings.

3. Use an Inclined Manometer or Magnehelic to determine the pressure drop across a dry evaporator coil. Since the moisture on an evaporator coil can vary greatly, measuring the pressure drop across a wet coil under field conditions could be inaccurate. To assure a dry coil, the compressors should be de-activated while the test is being run.

NOTE: De-energize the compressors before taking any test measurements to assure a dry evaporator coil.

4. The CFM through the unit can be determined from the pressure drop indicated by the manometer by referring to Figure 28. In order to obtain an accurate measurement, be certain that the air filters are clean.
5. To adjust Measured CFM to Required CFM, see.
6. After readings have been obtained, remove the tubes and replace the dot plugs.
7. Tighten blower pulley and motor sheave set screws after any adjustments. Re-check set screws after 10-12 hrs. run time is recommended.

⚠WARNING

Failure to properly adjust the total system air quantity can result in extensive blower damage.

Method Two

1. Drill two 5/16 inch holes, one in the return air duct as close to the inlet of the unit as possible, and another in the supply air duct as close to the outlet of the unit as possible.
2. Using the whole drilled in step 1, insert eight inches of 1/4 inch metal tubing into the airflow of the return and supply air ducts of the unit.

NOTE: The tubes must be inserted and held in position perpendicular to the airflow so that velocity pressure will not affect the static pressure readings.

3. Use an Inclined Manometer or Magnehelic to determine the pressure drop across the unit. This is the External Static Pressure (ESP). In order to obtain an accurate measurement, be certain that the air filters are clean.
4. Determine the number of turns the variable motor sheave is open.
5. Select the correct blower performance table for the unit from Tables 15 and 16. Tables are presented for side and downflow configuration.
6. Determine the unit Measured CFM from the Blower Performance Table, External Static Pressure and the number of turns the variable motor sheave is open.
7. To adjust Measured CFM to Required CFM, see SUPPLY AIR DRIVE ADJUSTMENT.
8. After reading has been obtained, remove the tubes and seal holes.
9. Tighten blower pulley and motor sheave set screws after any adjustments. Re-check set screws after 10-12 hrs. run time is recommended.

NOTE: With the addition of field installed accessories repeat this procedure.

⚠WARNING

Failure to properly adjust the total system air quantity can result in extensive blower damage.

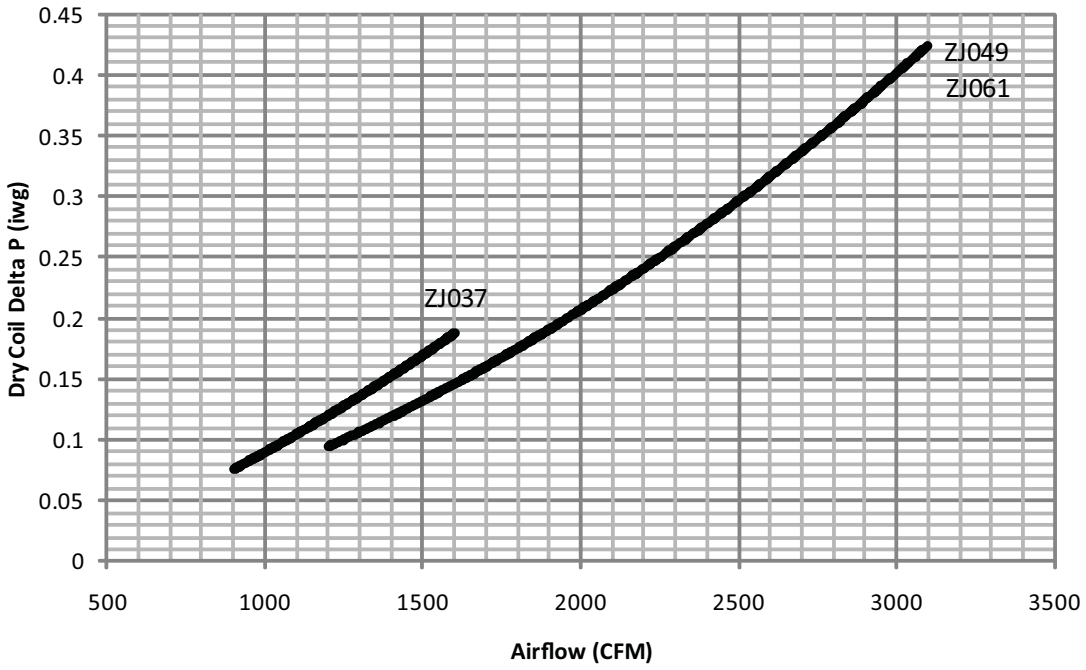


Figure 28: Dry Coil Delta P

Supply Air Drive Adjustment

⚠ CAUTION

Before making any blower speed changes review the installation for any installation errors, leaks or undesirable systems effects that can result in loss of airflow.

Even small changes in blower speed can result in substantial changes in static pressure and BHP. BHP and AMP draw of the blower motor will increase by the cube of the blower speed. Static pressure will increase by the square of the blower speed. Only qualified personnel should make blower speed changes, strictly adhering to the fan laws.

At unit start-up, the measured CFM may be higher or lower than the required CFM. To achieve the required CFM, the speed of the drive may have adjusted by changing the datum diameter (DD) of the variable pitch motor sheave as described below:

$$\left(\frac{\text{4,000 CFM}}{\text{3,800 CFM}}\right) \bullet \text{4.0 in.} = \text{4.21 in.}$$

Use the following tables and the DD calculated per the above equation to adjust the motor variable pitch sheave.

EXAMPLE

A 12.5 ton unit was selected to deliver 4,000 CFM with a 3 HP motor, but the unit is delivering 3,800 CFM. The variable pitch motor sheave is set at 2 turns open.

Use the equation to determine the required DD for the new motor sheave,

$$\left(\frac{\text{Required CFM}}{\text{Measured CFM}}\right) \bullet \text{Existing DD} = \text{New DD}$$

Use Table 20 to locate the DD nearest to 4.21 in. Close the sheave to 1 turn open.

New BHP

= (Speed increase)^3 • BHP at 3,800 CFM

= (Speed increase)^3 • Original BHP

= New BHP

New motor Amps

= (Speed increase)^3 • Amps at 3,800 CFM

= (Speed increase)^3 • Original Amps

= New Amps

Table 20: Motor Sheave Datum Diameters

1VM34x7/8 (1-1/2 HP Motor)		1VL44x7/8 (1-1/2 HP Motor)		1VL40x7/8 (1-1/2 HP Motor)		1VP56x7/8 (2 HP Motor)	
Turns Open	**Datum Diameter**	**Turns Open**	**Datum Diameter**	**Turns Open**	**Datum Diameter**	**Turns Open**	**Datum Diameter**
0	3.0	0	4.0	0	3.6	0	5.2
1/2	2.9	1/2	3.9	1/2	3.5	1/2	5.1
1	2.8	1	3.8	1	3.4	1	5
1-1/2	2.7	1-1/2	3.7	1-1/2	3.3	1-1/2	4.9
2	2.6	2	3.6	2	3.2	2	4.8
2-1/2	2.3	2-1/2	3.5	2-1/2	3.1	2-1/2	4.7
3	2.4	3	3.4	3	3.0	3	4.6
3-1/2	2.3	3-1/2	3.3	3-1/2	2.9	3-1/2	4.5
4	2.2	4	3.2	4	2.8	4	4.4
4-1/2	2.1	4-1/2	3.1	4-1/2	2.7	4-1/2	4.3
5	2.0	5	3.0	5	2.6	5	4.2

⚠ CAUTION

Belt drive blower systems MUST be adjusted to the specific static and CFM requirements for the application. The Belt drive blowers are NOT set at the factory for any specific static or CFM. Adjustments of the blower speed and belt tension are REQUIRED. Verify proper sheave alignment; tighten blower pulley and motor sheave set screws after these adjustments. Re-checking set screws after 10-12 hrs. run time is recommended.

Table 21: Additional Static Resistance

Size (Tons)	Model	CFM	Cooling Only[1]	Economizer[2 3]	4" Pleated Filter[2]	Electric Heat kW[2]					
						3	6	9	15	20	24
037 (3)	ZJ	900	0.05	-0.05	0.01	0.00	0.00	0.00	0.01	0.01	0.01
		1000	0.05	-0.03	0.02	0.00	0.00	0.00	0.02	0.02	0.02
		1100	0.04	-0.02	0.03	0.01	0.01	0.01	0.02	0.02	0.02
		1200	0.04	0.00	0.04	0.01	0.01	0.01	0.02	0.02	0.02
		1300	0.03	0.01	0.05	0.01	0.01	0.01	0.03	0.03	0.03
		1400	0.03	0.03	0.07	0.02	0.02	0.02	0.03	0.03	0.03
		1500	0.03	0.04	0.08	0.02	0.02	0.02	0.04	0.04	0.04
049 (4) 061 (5)	ZJ	1200	-0.01	0.10	0.05	0.01	0.01	0.01	0.02	0.02	0.02
		1300	-0.01	0.11	0.06	0.01	0.01	0.01	0.03	0.03	0.03
		1400	-0.01	0.12	0.06	0.02	0.02	0.02	0.03	0.03	0.03
		1500	-0.01	0.13	0.07	0.02	0.02	0.02	0.04	0.04	0.04
		1600	-0.01	0.14	0.08	0.02	0.02	0.02	0.04	0.04	0.04
		1700	-0.01	0.15	0.08	0.03	0.03	0.03	0.05	0.05	0.05
		1800	-0.02	0.16	0.09	0.03	0.03	0.03	0.05	0.05	0.05
		1900	-0.02	0.17	0.10	0.04	0.04	0.04	0.06	0.06	0.06
		2000	-0.02	0.18	0.10	0.04	0.04	0.04	0.07	0.07	0.07
		2100	-0.03	0.19	0.11	0.05	0.05	0.05	0.07	0.07	0.07
		2200	-0.03	0.20	0.12	0.06	0.06	0.06	0.08	0.08	0.08
		2300	-0.04	0.21	0.12	0.06	0.06	0.06	0.09	0.09	0.09
		2400	-0.04	0.22	0.13	0.07	0.07	0.07	0.10	0.10	0.10
		2500	-0.05	0.23	0.14	0.08	0.08	0.08	0.11	0.11	0.11

1. Add these values to the available static resistance in the respective Blower Performance Tables.
2. Deduct these values from the available external static pressure shown in the respective Blower Performance Tables.
3. The pressure drop through the economizer is greater for 100% outdoor air than for 100% return air. If the resistance of the return air duct is less than 0.25 IWG, the unit will deliver less CFM during full economizer operation.

Operation

Cooling Sequence Of Operation

For the Predator® series of units, the thermostat makes a circuit between "R" and "Y1" for the first stage of cooling.

The call is passed to the **Unit Control Board (UCB),** which then determines whether the requested operation is available and, if so, which components to energize.

For gas heating, the UCB monitors the "W1" call but does not handle the operation of the gas furnace. An ignition control board controls the gas heater operation. For electric heat units, the UCB passes the call to the electric heater. In both cases, when the "W1" call is sensed, the indoor air blower is energized following a specified heating delay.

If at any time a call for both heating and cooling are present, the heating operation will be performed. If operating, the cooling system is halted as with a completion of a call for cooling. Heating always takes priority.

Continuous Blower

By setting the room thermostat fan switch to "ON," the supply air blower will operate continuously.

Intermittent Blower

With the room thermostat fan switch set to "AUTO" and the system switch set to either the "AUTO" or "HEAT" settings, the blower is energized whenever a cooling or heating operation is requested. The blower is energized after any specified delay associated with the operation.

When energized, the indoor blower has a minimum run time of 30 seconds. Additionally, the indoor blower has a delay of 10 seconds between operations.

No Outdoor Air Options

When the thermostat calls for cooling, the low-voltage control circuit from “R” to “Y1” and “G” is completed. The compressor and condenser fan motor are energized. After completing the specified fan on delay for cooling, the UCB will energize the blower motor.

Once the thermostat has been satisfied, it will de-energize Y1. If the compressor has satisfied its minimum run time, the compressor and condenser fan de-energize. Otherwise, the unit operates the cooling system until the minimum run time for the compressor has been completed. After the compressor de-energizes, the blower is stopped following the elapse of the fan off delay for cooling.

To be available, a compressor must not be locked-out due to a high or low-pressure switch or freezestat trip and the anti-short cycle delay (ASCD) must have elapsed.

Economizer With Single Enthalpy Sensor

When the room thermostat calls for cooling, the low voltage control circuit from “R” to “G” and “Y1” is completed. The UCB energizes the blower motor (if the fan switch on the room thermostat is set in the “AUTO” position) and drives the economizer dampers from fully closed to their minimum position. If the enthalpy of the outdoor air is below the setpoint of the enthalpy controller (previously determined), “Y1” energizes the economizer. The dampers will modulate to maintain a constant supply air temperature as monitored by the discharge air sensor. If the outdoor air enthalpy is above the setpoint, “Y1” energizes the compressor and condenser fan motor only.

Once the thermostat has been satisfied, it will de-energize “Y1”. If the compressor has satisfied its minimum run time, the compressor and condenser fan are de-energized. Otherwise, the unit operates the cooling system until the minimum run times for the compressor has been completed. After the compressor de-energizes, the blower is stopped following the elapse of the fan off delay for cooling, and the economizer damper goes to the closed position. If the unit is in continues fan operation the economizer damper goes to the min. position.

Economizer With Dual Enthalpy Sensors

The operation with the dual enthalpy sensors is identical to the single sensor except that a second enthalpy sensor is mounted in the return air. This return air sensor allows the economizer to choose between outdoor air and return air, whichever has the lowest enthalpy value, to provide maximum operating efficiency.

Economizer With Power Exhaust

A unit equipped with an economizer (single or dual enthalpy) and a power exhaust operates as specified above with one addition. The power exhaust motor is energized 45 seconds after the actuator position exceeds the exhaust fan set point on the economizer control. As always, the "R" to "G" connection provides minimum position but does not provide power exhaust operation.

Motorized Outdoor Air Dampers

This system operation is the same as the units with no outdoor air options with one exception. When the "R" to "G" circuit is complete, the motorized damper drives open to a position set by the thumbwheel on the damper motor. When the "R" to "G" circuit is opened, the damper spring returns fully closed.

Cooling Operation Errors

Each cooling system is monitored for operation outside of the intended parameters. Errors are handled as described below. All system errors override minimum run times for compressors.

High-Pressure Limit Switch

During cooling operation, if a high-pressure limit switch opens, the UCB will de-energize the associated compressor, initiate the ASCD (Anti-short cycle delay), and, if the other compressor is idle, stop the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a high-pressure switch open three times within two hours of operation, the UCB will lock-out the associated compressor and flash a code (see Table 27). If the other compressor is inactive, the condenser fans will be de-energized.

Low-Pressure Limit Switch

The low-pressure limit switch is not monitored during the initial 30 seconds of a cooling system's operation. For the following 30 seconds, the UCB will monitor the low-pressure switch to ensure it closes. If the low-pressure switch fails to close after the 30-second monitoring phase, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans.

Once the low-pressure switch has been proven (closed during the 30-second monitor period described above), the UCB will monitor the low-pressure limit switch for any openings. If the low-pressure switch opens for greater than 5 seconds, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans.

If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a low-pressure switch open three times within one hour of operation, the UCB will lock-out the associated compressor and flash a code (Table 27). If the other compressor is inactive, the condenser fans will be de-energized.

Freezestat

During cooling operation, if a freezestat opens, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a freezestat open three times within two hours of operation, the UCB will lock-out the associated compressor and flash a code (Table 27). If the other compressor is inactive, the condenser fans will be de-energized.

Low Ambient Cooling

To determine when to operate in low ambient mode, the UCB has a pair of terminals connected to a temperature-activated switch set at 45ºF. When the low ambient switch is closed and the thermostat is calling for cooling, the UCB will operate in the low ambient mode.

Low ambient mode operates the compressors in this manner: 10 minutes on, 5 minutes off. The indoor blower is operated throughout the cycle. The 5-minute off period is necessary to defrost the indoor coil.

Low ambient mode always begins with compressor operation. Compressor minimum run time may extend the minutes of compressor operation. The defrost cycle will begin immediately following the elapse of the minimum run time.

When operating in low ambient mode, the UCB will not lockout the compressors due to a freezestat trip. However, a freezestat trip will de-energize the associated compressor. If the call for cooling is still present at the end of the ASCD and the freezestat has closed, the unit will resume operation.

Safety Controls

The unit control board monitors the following inputs for each cooling system:

1. A suction line freezestat to protect against low evaporator temperatures due to a low airflow or a low return air temperature, (opens at 26 ± 5 °F and resets at 38 ± 5°F).
2. A high-pressure switch to protect against excessive discharge pressures due to a blocked condenser coil or a condenser motor failure, (opens at 625 ± 25 psig).
3. A low-pressure switch to protect against loss of refrigerant charge, (opens at 50 ± 5 psig).

The above pressure switches are hard-soldered to the unit. The refrigeration systems are independently monitored and controlled. On any fault, only the associated system will be affected by any safety/preventive action. The other refrigerant system will continue in operation unless it is affected by the fault as well.

The unit control board monitors the temperature limit switch of electric heat units and the temperature limit switch and the gas valve of gas furnace units.

Compressor Protection

In addition to the external pressure switches, the compressors also have inherent (internal) protection. If there is an abnormal temperature rise in a compressor, the protector will open to shut down the compressor. The UCB incorporates features to minimize compressor wear and damage. An **Anti-Short Cycle Delay (ASCD)** is utilized to prevent operation of a compressor too soon after its previous run. Additionally, a minimum run time is imposed any time a compressor is energized.

The ASCD is initiated on unit start-up and on any compressor reset or lock-out.

Flash Codes

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 27.

Reset

Remove the call for cooling, by raising thermostat setting higher than the conditioned space temperature. This resets any pressure or freezestat flash codes.

Electric Heating Sequence Of Operations

The following sequence describes the operation of the electric heat section.

Two-stage heating:

a. Upon a call for first stage heat by the thermostat, the heater relay (RA) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor. If the second stage of heat is required, heater relay (RB) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

b The thermostat will cycle the electric heat to satisfy the heating requirements of the conditioned space.

Electric Heat Operation Errors

Temperature Limit

If the UCB senses zero volts from the high temperature limit, the indoor blower motor is immediately energized.

This limit is monitored regardless of unit operation status, i.e. the limit is monitored at all times.

If the temperature limit opens three times within one hour, it will lock-on the indoor blower motor and a flash code is initiated (See Table 27).

Safety Controls

The UCB monitors the temperature limit switch of electric heat units.

The control circuit includes the following safety controls:

Limit Switch (Ls)

This control is located inside the heater compartment and is set to open at the temperature indicated in the Electric Heat Limit Setting Tables 22. It resets automatically. The limit switch operates when a high temperature condition, caused by inadequate supply air flow occurs, thus shutting down the heater and energizing the blower.

Table 22: Electric Heat Limit Setting

UNIT (TONS)	VOLTAGE	HEATER kW	LIMIT SWITCH OPENS °F
ZJ037 (3)	208/230	3	155
		6	155
		9	170
		15	170
ZJ049 (4)	208/230	6	155
		9	170
		15	170
		20	170
ZJ061 (5)	208/230	6	155
		9	170
		15	170
		20	170
		24	170
ZJ037 (3)	480	3	155
		6	155
		9	170
		15	170
ZJ049 (4)	480	6	155
		9	170
		15	170
		20	170
ZJ061 (5)	480	6	155
		9	170
		15	170
		20	170
		24	170
ZJ037 (3)	600	9	170
		15	170
ZJ049 (4)	600	9	170
		15	170
		20	170
ZJ061 (5)	600	9	170
		15	170
		20	170
		24	170

Flash Codes

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 27.

Reset

Remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature.This resets any flash codes.

Electric Heat Anticipator Setpoints

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter “ON” cycles and may result in the lowering of the temperature within the conditioned space. Refer to Table 23 for the required electric heat anticipator setting.

Table 23: Electric Heat Anticipator Setpoints

SETTING, AMPS	
W1	**W2**
0.13	0.1

Gas Heating Sequence Of Operations

When the thermostat calls for the first stage of heating, the low-voltage control circuit from “R” to “W1” is completed. A call for heat passes through the UCB to the **Ignition Control Board (ICB).** The UCB monitors the “W1” call and acts upon any call for heat by monitoring the **Gas Valve (GV).** Once voltage has been sensed at the GV, the UCB will initiate the fan on delay for heating, energizing the indoor blower the specified delay has elapsed.

When the thermostat has been satisfied, heating calls are ceased. The GV is immediately closed. The blower is de-energized after the fan off delay for heating has elapsed. The draft motor performs a 30-second post purge.

Ignition Control Board

First Stage Of Heating

When the ICB receives a call for first stage of heating, “W1,” the draft motor is energized. Once the draft motor has been proven, a 30-second purge is initiated. At the end of the purge, the GV is opened, and the spark ignitor is energized for 10 seconds. The ICB then checks for the presence of flame. If flame is detected, the ICB enters a flame stabilization period. If flame was not detected, the GV closes, and a retry operation begins.

During the flame stabilization period, a loss of the flame for 2 seconds will cause the GV to close and the retry operation to begin. After the flame stabilization period, a loss of flame for 3/4 second will cause the GV to close and the retry operation to begin.

At the conclusion of the flame stabilization period, the ICB will operate the gas heat in high fire for an additional 60 seconds (for a total for 120 seconds of high fire operation). After this 60 seconds, the ICB will then use the call for the second stage of heat to control second stage operation of the GV.

When “W1” is satisfied, both valves are closed.

Second Stage Of Heating

When the ICB receives a call for the second stage of heating, “W2,” the ICB conducts a complete first stage ignition sequence. If this sequence is satisfied, the second main valve of the GV is opened.

When “W2” is satisfied, the second main valve is closed.

Retry Operation

When a flame is lost or is not detected during an attempt to achieve ignition, a retry operation occurs. A 30-second purge is performed between ignition attempts.

If the unit fails after three ignition attempts, the furnace is locked-out for one hour. The furnace is monitored during this one-hour period for unsafe conditions.

Recycle Operation

When a flame is lost after the flame stabilization period, a recycle operation occurs. If the unit fails after five recycle attempts, the furnace is locked-out for one hour.

Gas Heating Operation Errors

Lock-Out

A one-hour lockout occurs following three retries or five recycles. During the one-hour lockout, flame detection, limit conditions, and main valves are tested. Any improper results will cause the appropriate action to occur. Recycling the low voltage power cancels the lock-out.

Temperature Limit

If the UCB senses zero volts from the high temperature limit, the indoor blower motor is immediately energized. When the UCB again senses 24 volts from the temperature limit, the draft motor will perform a 15-second post-purge and the indoor blower will be de-energized following the elapse of the fan off delay for heating.

This limit is monitored regardless of unit operation status, i.e. this limit is monitored at all times.

If the temperature limit opens three times within one hour, it will lock-on the indoor blower motor and flash code is initiated (See Table 27).

Flame Sense

Flame sensing occurs at all times. If “W1” is not present and a flame is sensed for 2 seconds, the draft motor is energized and the GV is kept off. The ICB halts any operation until a flame is not detected. Once the flame detection is lost, the ICB performs a post-purge. Normal operation is allowed concurrently with the purge (i.e. this purge can be considered the purge associated with a call for “W1”).

If “W1” is present, a flame is sensed, but the GV is not energized, the draft motor is energized until the flame detection is lost. Normal operation is now allowed.

The flame detection circuitry continually tests itself. If the ICB finds the flame detection circuitry to be faulty, the ICB will not permit an ignition sequence and the draft motor is energized. If this failure should occur during an ignition cycle the failure is counted as a recycle.

Gas Valve

The UCB and ICB continuously monitor the GV.

If the ICB senses voltage at the GV when not requested, the ICB will energize the draft motor. The ICB will not operate the furnace until voltage is no longer sensed at the GV. The draft motor is stopped when voltage is not sensed at the GV.

Any time the UCB senses voltage at the GV without a call for heat for a continuous five-minute period, the UCB will lock-on the indoor blower and a flash code is initiated (Table 28). When voltage is no longer sensed at the GV, the UCB will de-energize the indoor blower following the elapse of the fan off delay for heating.

If voltage has been sensed at the GV for at least 15 seconds during the fan on delay for heating and GV voltage or “W1” is lost, the indoor blower is forced on for the length of the fan off delay for heating.

During a call for heat, if the UCB does not sense voltage at the GV for a continuous five-minute period the UCB will initiate a flash code (Table 27). The indoor blower motor will not be locked-on while there is no GV voltage.

Safety Controls

The UCB monitors the temperature limit switch of gas heat units.

The control circuit includes the following safety controls:

Limit Switch (LS)

This control is located inside the gas heat compartment and is set to open at the temperature indicated in Table 9. It resets automatically. The limit switch operates when a high temperature condition, caused by inadequate supply air flow occurs, thus shutting down the heater and energizing the blower.

Auxiliary Limit Switch (ALS)

This control is located inside the supply air compartment and is set to open at the temperature indicated in Table 9. It resets manually. The limit switch operates when a high temperature condition, caused by inadequate supply air flow occurs, thus shutting down the heater and energizing the blower.

The auxiliary limit switch is wired in series with the limit switch. As such, the UCB cannot distinguish the auxiliary limit and the gas heat limit switch operation except the auxiliary is manual reset. Consequently, the control will respond in the same manner as outlined above under “Limit Switch”.

The ICB monitors the Pressure and Rollout switches of gas heat units.

The control circuit includes the following safety controls:

Pressure Switch (PS)

Once the draft motor has reached full speed and closes the pressure switch during a normal ignition sequence, if the pressure sw opens for 2 seconds, the GV will be de-energized, the ignition cycle is aborted, and the ICB flashes the appropriate code. See Table 28 Ignition Control Flash Codes. The draft motor is energized until the pressure switch closes or “W1” is lost.

Rollout Switch (ROS)

The rollout switch is wired in series with the pressure switch. As such, the ICB cannot distinguish the rollout switch operation from that of the pressure switch.

Consequently, the control will only respond in the same manner as outlined above under “Pressure Switch”. An open rollout will inhibit the gas valve from actuating.

Internal Microprocessor Failure

If the ICB detects an internal failure, it will cease all outputs, ignore inputs, and display the proper flash code for control replacement. The ICB remains in this condition until replaced.

Flash Codes

The ICB will initiate a flash code associated with errors within the system. Refer to IGNITION CONTROL FLASH CODES Table 28.

Resets

Remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature. This resets any flash codes.

Gas Heat Anticipator Setpoints

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter “ON cycles and may result in the lowering of the temperature within the conditioned space. Refer to Table 24 for the required gas heat anticipator setting.

Table 24: Gas Heat Anticipator Setpoints

SETTING, AMPS	
W1	**W2**
0.65	0.1

Start-Up (Cooling)

Prestart Check List

After installation has been completed:

1. Check the electrical supply voltage being supplied. Be sure that it is the same as listed on the unit nameplate.
2. Set the room thermostat to the off position.
3. Turn unit electrical power on.
4. Set the room thermostat fan switch to on.
5. Check indoor blower rotation.
   - If blower rotation is in the wrong direction. Refer to Phasing Section in general information section.

   Check blower drive belt tension.
6. Check the unit supply air (CFM).
7. Measure evaporator fan motor's amp draw.
8. Set the room thermostat fan switch to off.
9. Turn unit electrical power off.

Operating Instructions

1. Turn unit electrical power on.

NOTE: Prior to each cooling season, the crankcase heaters must be energized at least 10 hours before the system is put into operation.

2. Set the room thermostat setting to lower than the room temperature.
3. First stage compressors will energize after the built-in time delay (five minutes).
4. The second stage of the thermostat will energize second stage compressor if needed.

Post Start Check List

1. Verify proper system pressures for both circuits.
2. Measure the temperature drop across the evaporator coil.

Start-Up (Gas Heat)

Pre-Start Check List

Complete the following checks before starting the unit.

1. Check the type of gas being supplied. Be sure that it is the same as listed on the unit nameplate.
2. Make sure that the vent outlet and combustion air inlet are free of any debris or obstruction.

Operating Instructions

⚠ CAUTION

This furnace is equipped with an automatic re-ignition system. DO NOT attempt to manually light the pilot.

Lighting The Main Burners

1. Turn “OFF” electric power to unit.
2. Turn room thermostat to lowest setting.
3. Turn gas valve counter-clockwise to “ON” position (See Figure 30).
4. Turn “ON” electric power to unit.
5. If thermostat set temperature is above room temperature, the main burners will ignite. If a second stage of heat is called for, the main burners for second stage heat will ignite for the second stage heat.

Post Start Checklist

After the entire control circuit has been energized and the heating section is operating, make the following checks:

1. Check for gas leaks in the unit piping as well as the supply piping.

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

2. Check for correct manifold gas pressures. (See CHECKING GAS INPUT.)
3. Check the supply gas pressure. It must be within the limits shown on the rating nameplate. Supply pressure should be checked with all gas appliances in the building at full fire. At no time should the standby gas pressure exceed 10.5 in. or the operating pressure drop below 4.5 in for natural gas units. If gas pressure is outside these limits, contact the local gas utility or propane supplier for corrective action.

Shut Down

1. Set the thermostat to the lowest temperature setting.
2. Turn “OFF” all electric power to unit.
3. Open gas heat access panel.
4. Turn gas valve clockwise to “OFF” position (See Figure 30).

Checking Gas Heat Input

This unit has two stages of gas heat. The first stage is 70% of the full fire input and is considered the minimum input for the furnace. The intended input for each furnace is shown in Table 26. The table applies to units operating on 60 Hz power only.

To determine the rate of gas flow (Second Stage).

1. Turn off all other gas appliances connected to the gas meter.
2. Turn on the furnace and make sure the thermostat is calling for Second stage (100% input) heat.
3. Measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical gas meter has a 1/2 or a 1 cubic foot test dial.
4. Using the number of seconds it takes for one revolution of the dial, calculate the cubic feet of gas consumed per hour. (See example below).
5. If necessary, adjust the high pressure regulator as discussed in the section “Manifold Gas Pressure Adjustment”. **Be sure not to over-fire** the furnace on Second stage. If in doubt, it is better to leave the Second stage of the furnace slightly under-fired. Repeat Steps 1-5.

To determine the rate of gas flow (First Stage)

1. Turn off all other gas appliances connected to the gas meter.
2. Turn on the furnace and make sure the thermostat is calling for first stage (70% input) heat.
3. Even when the thermostat is calling for first stage heat, the unit will light on second stage and will run on Second stage for 1 minute. Allow this one-minute time period to expire and be certain the unit is running on first stage.
4. Measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical gas meter has a 1/2 or a 1 cubic foot test dial.
5. Using the number of seconds it takes for one revolution of the dial, calculate the cubic feet of gas consumed per hour (See example below).
6. If necessary, adjust the low pressure regulator as discussed in the section “Manifold Gas Pressure Adjustment”. **Be sure not to under-fire** the furnace on first stage. If in doubt, it is better to leave the first stage of the furnace slightly over-fired (greater than 70% input). Repeat Steps 1-6.

Table 25: Gas Rate Cubic Feet Per Hour

Seconds for One Rev.	Size of Test Dial	
	1/2 cu. ft.	1 cu. ft.
10	180	360
12	150	300
14	129	257
16	113	225
18	100	200
20	90	180
22	82	164
24	75	150
26	69	138
28	64	129
30	60	120
32	56	113
34	53	106
36	50	100
38	47	95
40	45	90
42	43	86
44	41	82
46	39	78
48	37	75
50	36	72
52	35	69
54	34	67
56	32	64
58	31	62
60	30	60

NOTE: To find the Btu input, multiply the number of cubic feet of gas consumed per hour by the Btu content of the gas in your particular locality (contact your gas company for this information as it varies widely from area to area).

EXAMPLE

By actual measurement, it takes 19 seconds for the hand on a 1 cubic foot dial to make a revolution with a 192,000 Btuh furnace running. To determine rotations per minute, divide 60 by 19 = 3.16. To calculate rotations per hour, multiply 3.16 • 60 = 189.6. Multiply 189.6 • 1 (0.5 if using a 1/2 cubic foot dial) = 189.6. Multiply 189.6 • (the Btu rating of the gas). For this example, assume the gas has a Btu rating of 1050 Btu/ft.^{3}. The result of 199,000 Btuh is within 5% of the 192,000 Btuh rating of the furnace.

Manifold Gas Pressure Adjustment

This gas furnace has two heat stages. Therefore, the gas valve has two adjustment screws located under a plastic protective cover. The second stage (100% input) adjustment screw is adjacent to the “HI” marking on the valve and the first stage (60% input) adjustment screw is located adjacent to the “LO” marking on the valve (See Figure 30).

Manifold pressure adjustment procedure.

Adjust second stage (100% input) pressure first, then adjust first stage (70% input) pressure.

1. Turn off all power to the unit.
2. Using the outlet pressure port on the gas valve, connect a manometer to monitor the manifold pressure.
3. Remove plastic cap covering HI and LO pressure adjustment screws.
4. Turn on power to the unit.
5. Set thermostat to call for second stage heat and start furnace.
6. If necessary, using a screwdriver, turn the second stage adjustment screw (adjacent to the “HI” marking on the valve) clockwise to increase manifold pressure or counterclockwise to decrease manifold pressure. **Be sure not to over-fire the unit on second stage**.
7. After the high manifold pressure has been checked, adjust the thermostat to call for first stage heat.
8. If necessary, using a screwdriver, turn the first stage adjustment screw (adjacent to the “LO” marking on the valve) clockwise to increase manifold pressure or counterclockwise to decrease manifold pressure. **Be sure not to under-fire the unit on first stage**.
9. Once pressure has been checked, replace the plastic cap covering the HI and LO pressure adjustment screws.

NOTE: When using natural gas, the manifold pressure for second stage (100% input) should be 3.5 IWG ± 0.3. The manifold pressure for first stage (60% input) when using natural gas should be 1.5 IWG ± 0.3.

Table 26: Gas Heat Stages

Unit		# of Burner Tubes	1st Stage Input (Mbh)	2nd Stage Input (Mbh)	Total Input (Mbh)
Size	Opt.				
037	A05	4	60	-	60
	A07	4	80	-	80
	A09	6	120	-	120
	N05	4	45	15	60
	N07	4	56	24	80
	N09	6	84	36	120
049	A05	4	60	-	60
	A07	4	80	-	80
	A09	6	120	-	120
	N05	4	45	15	60
	N07	4	56	24	80
	N09	6	84	36	120
061	A07	4	80	-	80
	A09	6	120	-	120
	A13	8	160	-	160
	N07	4	56	24	80
	N09	6	84	36	120
	N13	8	112	48	160

Adjustment Of Temperature Rise

The temperature rise (the difference of temperature between the return air and the heated air from the furnace) must lie within the range shown on the CSA rating plate and the data in Table 9.

After the temperature rise has been determined, the CFM can be calculated as follows:

$$CFM = \text{Btu Input} \cdot \frac{0.8}{(1.08 \cdot \Delta°F)}$$

After about 20 minutes of operation, determine the furnace temperature rise. Take readings of both the return air and the heated air in the ducts (about 6 feet from the furnace) where they will not be affected by radiant heat. Increase the blower CFM to decrease the temperature rise; decrease the blower CFM to increase the rise (See SUPPLY AIR DRIVE ADJUSTMENT).

NOTE: Each gas heat exchanger size has a minimum allowable CFM. Below this CFM, the limit will open.

Burners/Orifices Inspection/Servicing

Before checking or changing burners, pilot or orifices, CLOSE MAIN MANUAL SHUT-OFF VALVE AND SHUT OFF ALL POWER TO THE UNIT.

1. Open the union fitting just upstream of the unit gas valve and downstream from the main manual shut-off valve in the gas supply line.
2. Remove the screws holding each end of the manifold to the manifold supports.
3. Disconnect wiring to the gas valves and spark igniter(s). Remove the manifold & gas valve assembly. Orifices can now be inspected and/or replaced.

To service burners, complete step 4.

4. Remove the heat shield on top of the manifold supports. Burners are now accessible for inspection and/or replacement.

NOTE: Reverse the above procedure to replace the assemblies.

Make sure that burners are level and seat at the rear of the gas orifice.

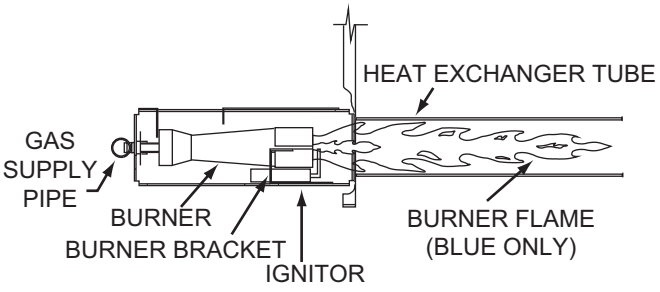


Figure 29: Typical Flame

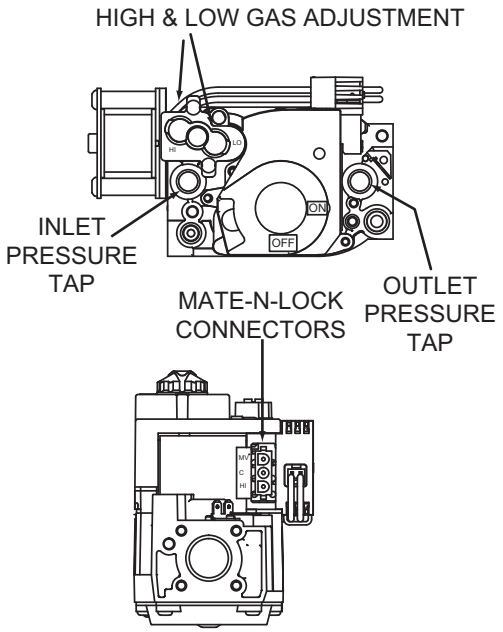


Figure 30: Typical Two Stage Gas Valve

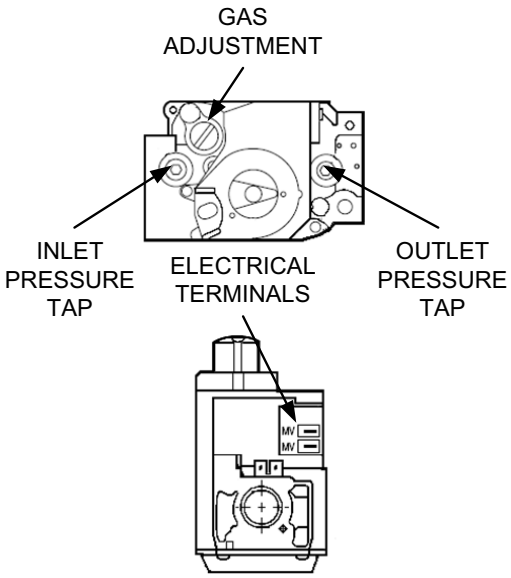


Figure 31: Typical Single Stage Gas Valve

Charging The Unit

All ZJ units use Thermal Expansion Devices. Charge the unit to 10° subcooling.

Troubleshooting

⚠ WARNING

Troubleshooting of components may require opening the electrical control box with the power connected to the unit. **Use extreme care when working with live circuits!** Check the unit nameplate for the correct line voltage and set the voltmeter to the correct range before making any connections with line terminals.

When not necessary, shut off all electric power to the unit prior to any of the following maintenance procedures so as to prevent personal injury.

⚠ CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation which could cause injury to person and/or damage unit components. Verify proper operation after servicing.

On calls for cooling, if the compressors are operating but the supply air blower motor does not energize after a short delay (the room thermostat fan switch is in the “AUTO” position).

1. Turn the thermostat fan switch to the ON position. If the supply air blower motor does not energize, go to Step 3.
2. If the blower motor runs with the fan switch in the ON position but will not run after the compressor has energized when the fan switch is in the AUTO position, check the room thermostat for contact between R and G in the AUTO position during calls for cooling.
3. If the supply air blower motor does not energize when the fan switch is set to ON, check that line voltage is being supplied to the contacts of the M3, contactor, and that the contactor is pulled in. Check for loose wiring between the contactor and the supply air blower motor.
4. If M3 is pulled in and voltage is supplied to M3, lightly touch the supply air blower motor housing. If it is hot, the motor may be off on internal protection. Cancel any thermostat calls and set the fan switch to AUTO. Wait for the internal overload to reset. Test again when cool.
5. If M3 is not pulled in, check for 24 volts at the M3 coil. If 24 volts are present at M3 but M3 is not pulled in, replace the contactor.
6. Failing the above, if there is line voltage supplied at M3, M3 is pulled in, and the supply air blower motor still does not operate, replace the motor.
7. If 24 volts is not present at M3, check that 24 volts is present at the UCB supply air blower motor terminal, “FAN”. If 24 volts is present at the FAN, check for loose wiring between the UCB and M3.
8. If 24 volts is not present at the “FAN” terminal, check for 24 volts from the room thermostat. If 24 volts are not present from the room thermostat, check for the following:
   a. Proper operation of the room thermostat (contact between R and G with the fan switch in the ON position and in the AUTO position during operation calls).
   b. Proper wiring between the room thermostat and the UCB.
   c. Loose wiring from the room thermostat to the UCB.
9. If 24 volts is present at the room thermostat but not at the UCB, check for proper wiring between the thermostat and the UCB, i.e. that the thermostat G terminal is connected to the G terminal of the UCB, and for loose wiring.
10. If the thermostat and UCB are properly wired, replace the UCB.

On a call for cooling, the supply air blower motor is operating but the compressor is not (the room thermostat fan switch is in the “AUTO” position).

1. If installed, check the position of the economizer blades. If the blades are open, the economizer is providing free cooling and the compressors will not immediately operate. If both stages of cooling are requested simultaneously and the economizer provides free cooling, following a short delay the compressor will be energized unless it is locked out, unless this option has been disabled through computer communications.
2. If no economizer is installed or the economizer is not opening to provide free cooling and the compressor does not energize on a call for cooling, check for line voltage at the compressor contactor, M1, and that the contactor is pulled in. Check for loose wiring between the contactor and the compressor.
3. If M1 is pulled in and voltage is supplied at M1, lightly touch the compressor housing. If it is hot, the compressor may be off on inherent protection. Cancel any calls for cooling and wait for the internal overload to reset. Test again when cool.
4. If M1 is not pulled in, check for 24 volts at the M1 coil. If 24 volts are present and M1 is not pulled in, replace the contactor.
5. Failing the above, if voltage is supplied at M1, M1 is pulled in, and the compressor still does not operate, replace the compressor.
6. If 24 volts is not present at M1, check for 24 volts at the UCB terminal, C1. If 24 volts is present, check for loose wiring between C1 and the compressor contactor.
7. If 24 volts is not present at the C1 terminal, check for 24 volts from the room thermostat at the UCB Y1 terminal. If 24 volts is not present from the room thermostat, check for the following:
   a. 24 volts at the thermostat Y1 terminal
   b. Proper wiring between the room thermostat and the UCB, i.e. Y1 to Y1, Y2 to Y2
   c. Loose wiring from the room thermostat to the UCB.

8. If 24 volts is present at the UCB Y1 terminal, the compressor may be out due to an open high-pressure switch, low-pressure switch, or freezestat. Check for 24 volts at the HPS1, LPS1, and FS1 terminals of the UCB. If a switch has opened, there should be a voltage potential between the UCB terminals, e.g. if LPS1 has opened, there will be a 24-volt potential between the LPS1 terminals.
9. If 24 volts is present at the UCB Y1 terminal and none of the protection switches have opened, the UCB may have locked out the compressor for repeat trips. The UCB should be flashing an alarm code. If not, press and release the ALARMS button on the UCB. The UCB will flash the last five alarms on the LED. If the compressor is locked out, cancel any call for cooling. This will reset any compressor lock outs.

NOTE: While the above step will reset any lockouts, the compressor may be held off for the ASCD. See the next step.

10. If 24 volts is present at the UCB Y1 terminal and none of the switches are open and the compressor is not locked out, the UCB may have the compressor in an ASCD. Check the LED for an indication of an ASCD cycle. The ASCD should time out within 5 minutes. Press and release the TEST button to reset all ASCDs.
11. If 24 volts is present at the UCB Y1 terminal and the compressor is not out due to a protective switch trip, repeat trip lock out, or ASCD, the economizer terminals of the UCB may be improperly wired. Check for 24 volts at the Y1 "OUT" terminal of the UCB. If 24 volts is present, trace the wiring from Y1 "OUT" for incorrect wiring. If 24 volts is not present at the Y1 "OUT" terminal, the UCB must be replaced.
12. *For units without economizers*: If 24 volts is present at the Y1 OUT terminal, check for 24 volts at the Y1 "ECON" terminal. If 24 volts is not present, check for loose wiring from the Y1 "OUT" terminal to the Mate-N-Lock plug, the jumper in the Mate-N-Lock plug, and in the wiring from the Mate-N-Lock plug to the Y1 "ECON" terminal.
13. *For units with economizers*: If 24 volts is present at the Y1 "OUT" terminal, check for 24 volts at the Y1 "ECON" terminal. If 24 volts is not present, check for loose wiring from the Y1 "OUT" terminal to the Mate-N-Lock plug, a poor connection between the UCB and economizer Mate-N-Lock plugs, loose wiring from the Mate-N-Lock plug to the economizer, back to the Mate-N-Lock plug, and from the Mate-N-Lock plug to the Y1 "ECON" terminal. If nothing is found, the economizer actuator may have faulted and is failing to return the 24-volt "call" to the Y1 "ECON" terminal even though the economizer is not providing free cooling. To test, disconnect the Mate-N-Locks and jumper between the WHITE and YELLOW wires of the UCB's Mate-N-Lock plug. If the compressor energizes, there is a fault in the economizer wiring or actuator.
14. The UCB can be programmed to lock out compressor operation during free cooling and in low ambient conditions. These options are not enabled by default. Local distributors can test the UCB for this programming.

    For units with factory installed economizers, the UCB is programmed to lock out compressor operation when the LAS set point is reached.

    For units without factory installed or with field installed economizers, the UCB allows compressor operation all the time. This programming can be checked or changed by the local distributor.
15. If none of the above correct the error, replace the UCB.

Gas Heat Troubleshooting Guide

⚠WARNING

Troubleshooting of components may require opening the electrical control box with the power connected to the unit. **Use extreme care when working with live circuits!** Check the unit nameplate for the correct line voltage and set the voltmeter to the correct range before making any connections with line terminals.

When not necessary, shut off all electric power to the unit prior to any of the following maintenance procedures so as to prevent personal injury.

⚠ CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation, which could cause injury to person and/or damage unit components. Verify proper operation after servicing.

⚠WARNING

The furnace may shut down on a high temperature condition during the procedure. If this occurs, the UCB energize the supply air blower motor until the high temperature limit has reset. Caution should be used at all times as the supply air blower may energize regardless of the room thermostat fan switch position.

On calls for heating, the draft motor operates and the furnace lights but the supply air blower motor does not energize after a short delay (the room thermostat fan switch is in “AUTO” position).

1. Place the thermostat fan switch in the “ON” position. If the supply air blower motor energizes, go to Step 9.
2. If the supply air blower motor does not energize when the fan switch is set to “ON,” check that line voltage is being supplied to the contacts of the M3 contactor, and that the contactor is pulled in. Check for loose wiring between the contactor and the supply air blower motor.
3. If M3 is pulled in and voltage is supplied at M3, lightly touch the supply air blower motor housing. If it is hot, the motor may be off on inherent protection. Cancel any thermostat calls and set the fan switch to “AUTO”, wait for the internal overload to reset. Test again when cool.
4. If M3 is not pulled in, check for 24 volts at the M3 coil. If 24 volts is present at M3 but M3 is not pulled in, replace the contactor.
5. Failing the above, if there is line voltage supplied at M3, M3 is pulled in, and the supply air blower motor still does not operate, replace the motor.
6. If 24 volts is not present at M3, check that 24 volts is present at the supply air blower motor terminal on the UCB. If 24 volts is present at the UCB terminal, check for loose wiring between the UCB and M3.
   a. If 24 volts is not present at the UCB supply air blower motor terminal, check for 24 volts from the room thermostat. If 24 volts is not present from the room thermostat, check for the following:
      - Proper operation of the room thermostat (contact between R and G with the fan switch in the “ON” position and in the “AUTO” position during operation calls.)
      - Proper wiring between the room thermostat and the UCB, and
      - Loose wiring from the room thermostat to the UCB
7. If 24 volts is present at the room thermostat but not at the UCB, check for proper wiring between the thermostat and the UCB, i.e. that the thermostat G terminal is connected to the G terminal of the UCB, and for loose wiring.
8. If the thermostat and UCB are properly wired, replace the UCB.
9. If the blower motor runs with the fan switch in the “ON” position but does not run shortly after the furnace has ignited when the fan switch is in the “AUTO” position, check the room thermostat for contact between R and G during “W1” calls.

On calls for heating, the supply air blower operates but the draft motor does not (the room thermostat fan switch is in the “AUTO” position).

1. The draft motor has inherent protection. If the motor shell is hot to the touch, wait for the internal overload to reset.
2. If the motor shell is cold with the room thermostat calling for heat, check for line voltage at the motor leads. If line voltage is present, replace the draft motor.
3. If line voltage is not present, check for line voltage on the ignition control at the “inducer” terminal draft motor relay (DMR or DMC) contacts in the main control box and check to see if the (DMR or DMC) is pulled in.

The draft motor runs but the furnace does not light and the spark ignitor does not spark.

1. Check for 24 volts at the spark ignitor from the ignition control board (ICB). Check the 24-volt wiring from the ICB to the spark ignitor. Check for 24 volts at the ICB spark ignitor terminal.
2. Check the ground wiring for the ICB and the gas valve is intact and making good electrical connection. Check the ceramic insulator on the spark ignitor for breaks or cracks. Replace the spark ignitor if damaged.
3. With the draft motor running, check for 24 volts at the pressure switch terminal on the ICB. If not present, check for 24 volts on the terminal from the pressure switch. If present, go to step 4. If 24 volts is not present, the either pressure or rollout switch is not closed. Or the draft motor is not sufficiently evacuating the heat exchanger tubes or the pressure switch has failed. Check the operation of the pressure switch. Check the line voltage to the unit; if line voltage is low, call the local power company. If the problem persists, the draft motor may need replacement.
4. If the furnace is hot, it may be out on a high temperature limit open; wait for limit reset.
5. If all are intact replace the ICB.

The draft motor runs and the spark ignitor sparks at the burner, but the burner does not ignite and a gas odor is not detected at the draft motor outlet.

1. Check to ensure gas is being supplied to the unit. Confirm that the gas pressure to the unit is within the proper limits as described in the “POST START CHECKLIST”.
2. Check the voltage at the gas valve and at the gas valve terminals on the ICB. Check all wiring between the ICB and the gas valve. Check to make sure the ground connections are intact.
3. If 24 volts is present, remove the pilot burner and the orifice. The removal procedure is described in “BURNER/ ORIFICE INSPECTION/SERVICING.” Inspect the orifice for obstruction. If it is clear, replace the gas valve.

Main burners light but exhibit erratic flame characteristics.

1. Check the main burner orifices for obstruction and alignment. The removal procedure is described in “BURNER/ORIFICE INSPECTION/SERVICING”. Clean or replace burner orifices and burners as needed.

Unit Flash Codes

Various flash codes are utilized by the unit control board (UCB) and the ignition control board (ICB) to aid in troubleshooting. Flash codes are distinguished by the short on and off cycle used (approximately 200ms on and 200ms off). To show normal operation, the control boards flashes a 1 second on, 1 second off “heartbeat” during normal operation. This is to verify that the UCB and the ICB are functioning correctly. Do not confuse this with an error flash code. To prevent confusion, a 1-flash, flash code is not used.

Current alarms or active restrictions are flashed on the UCB LED.

- **LAST ERROR** - When this button is pressed and released one time within five seconds, it flashes the last five flash codes on the board’s LED. The most recent alarm is shown first and the oldest alarm is shown last.

  When pressed and released twice within a five second span, the fault history is cleared.
- **TEST RESET** - When this button is pressed and released one time within five seconds, any anti-short cycle delays (ASCD) is by-passed for one cycle.

  When this button is pressed twice within five seconds, any active lockouts are reset.
- **COMM SET UP** - If the board is to be networked with other units, this button is used to set the network address.

  The first time the button is pressed within five seconds, it scans the bus, then assigns itself the first available address {starts at 2}. It then flashes that address one time.

  Pressing the button two times within five seconds causes the control to flash its address.

  Pressing the button three times within five seconds forces the control to reset its address to 1, which is the factory default.

Current alarms or active restrictions are flashed on the ICB LED. No history is stored on the ICB.

Fan On And Off Delays

The fan ON and OFF delays can be field adjusted by pressing a combination of buttons on the UCB.

- **Gas Heat Option #1** - Press the ***LAST ERROR*** and ***TEST RESET*** buttons simultaneously and then release. The control flashes three times as it writes a 30 second delay ON and a 90 second delay OFF to the program.
- **Gas Heat Option #2** - Press the ***COMM SETUP*** and ***TEST RESET*** buttons simultaneously and then release. The control flashes four times as it writes a 30 second delay ON and a 180 second delay OFF to the program.
- **Electric Heat** - Press and release the ***COMM SETUP*** and ***LAST ERROR*** buttons at the same time. The control flashes twice on the LED as the control writes a 0 second ON and a 30 second OFF fan delay to the control’s program memory.

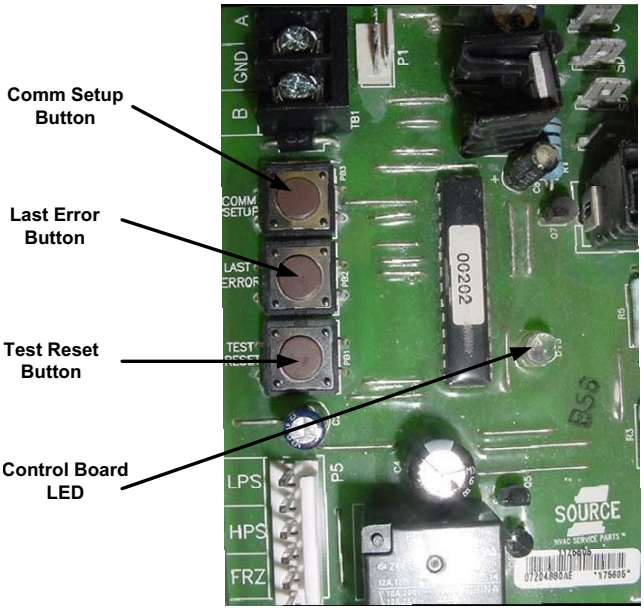


Figure 32: Unit Control Board

Table 27: Unit Control Board Flash Codes

Flash Code	Description
On Steady	Control Failure - Replace Control
Heart Beat	Normal Operation
1 Flash	Not Applicable
2 Flashes	Control waiting ASCD[1]
3 Flashes	HPS1 - Compressor Lock out
5 Flashes	LPS1 - Compressor Lock out
7 Flashes	FS1 - Compressor Lock out
9 Flashes	Ignition Control Locked Out/ Ignition Control Failure / Limit Switch Trip / No Jumper Plug in Heat Section
10 Flashes	Compressors Locked Out On Low Outdoor Air Temperature[1]
11 Flashes	Compressors Locked Out Because The Economizer Is Using Free Cooling[1]
13 Flashes	Compressor Held Off Due To Low Voltage[1]
14 Flashes	EEPROM Storage Failure (Control Failure)
OFF	No Power or Control Failure

1. These flash codes do not represent alarms.

Table 28: Ignition Control Flash Codes

Flashes	Fault Conditions	Check
Steady On	Control Failure	Control
Heartbeat	Normal Operation	
1	Not Applicable	
2	Pressure Switch Stuck Closed	Pressure Switch
3	Pressure Switch Failed To Close	Venter Pressure Switch Vent Blocked
4	Limit Switch Open	Main Limit AUX Limit
5	Flame Present With Gas Off First Stage Gas Valve Energized With W1 Off Second Stage Gas Valve Energized With First Stage Gas Valve Off	Gas Valve
6	Ignition Lockout	Gas Flow Gas Pressure Gas Valve Flame Sensor
Steady Off	No Power Or Control Failure	24VAC or Control

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